UNIVERSITY OF KENTUCKY

April 22, 2015

Andrew Hippisley
Chair, University of Kentucky Senate Council

Dear Dr. Hippisley,

The Senate Academic Organization and Structure Committee (SAOSC) discussed via email the proposal by G.Q. Zhang, Professor and Chief of the Division of Biomedical Informatics in the College of Medicine, to create an Institute for Biomedical Informatics. Scientists have been active in genomics and bioinformatics research at the University of Kentucky for over 20 years in many colleges. The University of Kentucky began investing in biomedical informatics in 2008 in connection with the creation of a Center for Clinical and Translation Science. The objective of this proposal is to harness and empower the research activities of scientists, campus wide through creation of this Multidisciplinary Research Institute.

The proposal is accompanied by letters of support from College Deans of Arts and Sciences, Public Health, Medicine, Pharmacy, Associate Dean of Research from Dentistry, Directors of several affiliated centers, chair for Department of Statistics, the College of Medicine Faculty Council and two faculty members from the College of Agriculture who have been active collaborators. Letters were not provided from Faculty Advisory committees from other colleges or deans, however, the committee discerned that there was widespread interest and support based on active participation in bioinformatics programs that have preceded and contributed to this proposal (See, for example, http://bioinformatics.cesb.uky.edu/bin/view/SBOI/AdministrationAndOversight; Systems Biology and Omics Integration Journal Club)

The SAOSC did not meet with Dr. Zhang but had an active email discussion about the proposal. Initially there were questions about the scope of the program, specifically if it was intended to be limited to those participating in the Division for Biomedical Informatics. Discussions with faculty outside the Medical Colleges alleviated those concerns. The situation appears to be the following: since biomedical informatics is important for biomedical research the College of Medicine has been proactive in creating a Division of Biomedical Informatics. At the same time, great synergistic benefits will be realize by this program and by diverse programs across campus by creating a healthy and active multidisciplinary research center.

I understand that the proposal will be accompanied by an addendum on Monday, April 25th that will further underline these points.

The SAOSC recommends approval of the proposed Institute for Biomedical Informatics.

Respectfully and on behalf of the SAOSC,

Ernest Bailey, PhD
Professor
Chair of SAOSC

COVER PAGE FOR CHANGES TO ACADEMIC ORGANIZATION OR STRUCTURE OF AN EDUCATIONAL UNIT

The Senate's Academic Organization and Structure Committee (SAOSC) is tasked by the University Senate with the review of proposals to change academic organization or structure. The information needed by the SAOSC for the review of such proposals is set forth in *Senate Rules 3.4.2.A.5*[1].

The SAOSC has developed a set of guidelines (from the *Senate Rules*) that are intended to ease the task of proposal submission (available at http://www.uky.edu/Faculty/Senate/forms.htm). As proposal omissions usually cause a delay in the review process, the individual(s) responsible for the proposal is (are) urged to familiarize themselves with these guidelines before submitting their proposals for review. In particular, the individual responsible for the proposal must fill out Sections I, II and III of this form, as well as include statements and documentation that provide a full accounting of the items a - i, below.

a. Disposition of faculty, staff and resources (financial and physical);
b. Willingness of the donating units to release faculty lines for transfer to a different educational unit;
c. Consultation with the faculty of the unit to which the faculty lines are proposed to be transferred;
d. Consultation with the faculty of educational unit that will be significantly reduced;
e. Summary of votes and viewpoints (including dissents) of unit faculty and department/college committees;
f. Ballots, votes expressing support for or against the proposal by unit faculty and staff and committees;
g. Letters of support or opposition from appropriate faculty and/or administrators; and
h. Letters of support from outside the University.

Section I – General Information about Proposal

One- to two-sentence description of change:	This is a proposal to formally create a new center called the Institute for Biomedical Informatics (IBI). The Institute's vision is to fulfill a campus-wide need for enhancing and coordinating biomedical informatics capacity across the colleges.				
Contact person name:	GQ Zhang, Ph.D.	Phone:	859-218-6142	Email:	gzh238@uky.edu
Administrative position (dean, chair, director, etc.):	Director and Division Chief, Internal Medicine				

Section II – Educational Unit(s) Potentially Impacted by Proposal

Check all that apply and name the specific unit(s).		
☒	Department of:	Internal Medicine
☐	School of:	
☒	College of:	Medicine
☐	Graduate Center for:	
☐	Interdisciplinary Instructional Program:	
☐	Multidisciplinary Research Center/Institute:	

Section III – Type of Proposal

Check all that apply.

[1] Items a-i are derived from *Senate Rules 3.4.2.A.5*. The Senate Rules in their entirety are available at http://www.uky.edu/Faculty/Senate/rules_regulations/index.htm.)

COVER PAGE FOR CHANGES TO ACADEMIC ORGANIZATION OR STRUCTURE OF AN EDUCATIONAL UNIT

A. Changes	
☐	Change to the name of an educational unit.
☐	Change to the type of educational unit (e.g., from department to school).
B. Other types of proposals	
☒	Creation of a new educational unit.
☐	Consolidation of multiple educational units.
☐	Transfer of an academic program to a different educational unit.
☐	Transfer of an educational unit to a different reporting unit.
☐	Significant reduction of an educational unit.
☐	Discontinuation, suspension or closure of an educational unit.
☐	Other (Give a one- or two-sentence description below; a complete description will be in the proposal.
	Creation of a new institute called the Institute for Biomedical Informatics

Section IV is for internal use/guidance.

Section IV – Guidance for SAOSC, Senate Council and University Senate

SAOSC Review of Type A Proposals (Changes to Type of, or to Name of, an Educational Unit)

- ✓ SAOSC review of proposal.
- ✓ SAOSC recommendation for an additional or joint review by other Senate committee(s) (e.g. Senate's Academic Programs Committee).

SAOSC Review of Type B Proposals (All Other Changes)

- ✓ SAOSC review of proposal.
- ✓ SAOSC recommendation for an additional or joint review by other Senate committee(s) (e.g. Senate's Academic Programs Committee).
- ✓ SAOSC review of proposals for creation, consolidation, transfer, closure, discontinuation, or significant reduction and educational unit, or transfer of an academic program to a different educational unit (attach documentation).
- ✓ Program review in past three years (attach documentation).
- ✓ Request to Provost for new program review (attach documentation).
- ✓ Open hearing (attach documentation).
  - SAOSC information must be shared with unit 10 days prior to hearing.
  - Open hearing procedures disseminated.

Voting by SAOSC, Senate Council and University Senate

- ✓ Endorse (or do not endorse) the academic organization, reporting, infrastructure, etc.
  - This vote is taken by the SAOSC, SC and Senate <u>for every SAOSC proposal</u>.
- ✓ Approve (or do not approve) the academic status or content of academic program.
  - This vote is taken by the SAOSC, SC and Senate <u>only when the review involves an MDRC</u>.

1) What is the impetus for the proposed change?

Response: Please see Executive Summary and Introduction (**pages 1-2**) as well as Background (**pages 4-5**) of the Proposal.

2) What are the benefits and weaknesses of the proposed unit with specific emphasis on the academic merits for the proposed change?

Response: Please see Vision and Goals (**pages 2-3**). No weaknesses as of now.

3) Describe the organization of the current structure and how the proposed structure will be different and better. Current and proposed organizational charts are often helpful in illustrating reporting lines.

Response: Please see Organization (**pages 5-9**).

4) How does the change fit with department, college, and/or university objectives and priorities?

Response: Please see Vision and Goals (**pages 2-3**).

5) How does this change better position the proposers relative to state and national peers, as well as University Benchmark Institutions? How does the change help UK meet the goals of its strategic plan?

Response: Please see Sample IBI Initiatives (**pages 12-13**).

6) Who are the key personnel associated with the proposed unit? Provide qualifications of these personnel in a brief form. A complete curriculum vitae for each person is not needed, although pertinent information in tabular format is helpful.

Response: Please see Organization (**pages 5-9**).

7) Discuss leadership and selection process for appointing a chair, a director, or interim leader and search process, etc.

Response: The selection of IBI's inaugural director is a result of an extensive search process over the past two years. The search committee, chaired by **Drs. Phil Kern and Jeffery Talbert**, clarified the attributes an individual must possess to develop biomedical informatics at the University of Kentucky and worked to recruit such a leader. Dr. GQ Zhang, a leading biomedical scientist from Case Western Reserve University was succeffuly recruited to fill this role.

8) What is the function of the faculty/staff associated with the proposed change and how is that relationship defined? Discuss DOE, adjunct, full-time, voting rights, etc.

Response: The primary faculty of IBI will be faculty in the Division of Biomedical Informatics. They will function as a typical faculty, governed by the standard College of Medicine roles, policies and procedures for a division and departmnent.

9) Will the proposed change involve multiple schools or colleges?

Response: Not at this point, but once IBI is established, memership in the IBI will include, but not limited to the faculty listed on **pages 6-10** of the proposal. Before the establishment, memership in IBI cannot be formalized.

10) If the proposed change will involve transferring personnel from one unit to another, provide evidence that the donor unit is willing and able to release the personnel.

Response: The formal transfer of 5 faculty members (Eric Durbin, Sally Ellingston, Rama Kavuluru, Sujin Kim, Radha Nagarajan) from College of Public Health to the College of Medicine **was completed in November, 2015.**

11) What is the arrangement of faculty associated with the proposed change and how is that relationship defined? Discuss faculty DOE and status as adjunct, tenure track, or tenured. Describe the level of faculty input in the policy-making process including voting rights and advisory.

Response:

- **Tenured**: GQ Zhang (Professor and Diretor), Radha Nagarajan (Associate Professor), Sujin Kim (Associate Professor);
- **Tenture Track**: Rama Kavuluru (Assistant Professor)
- **Research Assistant Professor:** Licong Cui, Eric Durbin, Sally Ellingston.

The DOE of each faculty appears in the table below.

Name	Research	Teaching	Service	Professional Devlopment
Cui	90	0	0	5
Durbin	90	0	0	5
Ellingston	90	0	0	5
Kavuluru	65	15	15	5
Kim*	35	45	15	5
Nagarajan	65	15	15	5
Zhang	50	15	30	5

*: Dr. Kim has 30% DOE for teaching supported by College of Communication & Information.

The level of faculty input in the policy-making process including voting rights and advisory roles are governed by the existing College of Medicine's roles, policies and procedures for a division and departmnent.

12) Discuss any implications of the proposal for accreditation by SACS and/or other organizations.

Response: It could potentially enhance the accreditation of degree programs such as Computer Science.

13) What is the timeline for key events in the proposed change? Student enrollments, graduates, moved programs, closed courses, new faculty and staff hires, etc.

Response: Three new staff members have already been hired. A total of 4 new faculty hires are planned in the next couple of years. Advertisement for 2 faculty positions has been placed for fall 2016. A biomedical informatics track is been revitalized in Computer Science. The existing BMI courses offered in the College of Public Health are to be reexamined and transferred to the College of Medicine in Spring 2016.

14) If the proposal involves degree changes, describe how the proposed structure will enhance students' education and make them more competitive. Discuss the impact on current and future students. State assumptions underlying student enrollment growth and describe the plans for student recruitment.

Response: NA

15) Include evidence that adequate financial resources exist for the proposed unit to be viable. A general description of the new costs and funding should be provided. A letter from the Provost, Dean, or other relevant administrators may affirm commitment to provide financial resources as appropriate. An exhaustive budget is not expected.

Response: Please see **page 12.**

16) The proposal should document any faculty votes and departmental or school committee votes as appropriate leading up to this point in the process. The SAOSC recommends that faculty votes be by secret ballot. Include in your documentation of each vote taken the total number of eligible voters and the number that actually voted along with the break-down of the vote into numbers for, against and abstaining. A Chair or Dean may appropriately summarize supporting and opposing viewpoints expressed during faculty discussions.

Response:
UK began investing in biomedical informatics in 2008 as part of the original CTSA proposal. The CTSA is the largest single grant on campus, about $20M over 5 years, and a strong informatics component is a requirement for its contiuned viability. A unique feature of our campus is that the UK biomedical campus is located side by side with the main Lexington campus—we are one University spanning the entire spectrum of academic Colleges. With the success of the CTSA proposal and the creation of the Center for Clinical and Translational Science, we established a division of biomedical informatics and began to recruit focused research faculty. In addition, we established the UK CCTS Enterprise Data Trust (EDT) to develop clinical data as a strategic asset for researchers across UK.

However, nascent efforts across campus to develop various informatics capabilities are at risk of staying decentralized and eventually disappearing as relevant faculty are lost to competing institutions. Since the CCTS biomedical informatics effort has reached a critical mass of faculty, staff, and research infrastructure, the coordination of these resources with those across the entire University is crucial to our long-term success. The creation of the IBI will link the CCTS BMI resources to faculty and students with similar

interest across campus to provide a coordinated locus of faculty, staff, and research infrastructure. The IBI will encompass activities occurring across a multitude of Colleges related to the field of biomedical informatics. Institute faculty hold appointments in colleges throughout UK. These activities include bioinformatics (omics-focused), clinical informatics, and public health informatics. Therefore, the IBI will become a nexus for all research and scholarly activities concerning biomedical informatics and will provide health-focused informatics services, training, and education for UKHC.

17) The committee will want to see evidence of academic merit and support from key parties. Letters of support (or opposition) are encouraged from the relevant senior faculty and administrators. Relevant faculty and administrators include those in units directly involved in the proposed change (including existing units from which a new unit may be formed.)

Response: **Please see attached support letters from the deans of Engineering, Publich Health, Phamacy as well as the earlier letter from CCTS director**.

18) Indicate how the new structure will be evaluated as to whether it is meeting the objectives for its formation. Timing of key events is helpful.

Response: The IBI will be reviewed and evaluated by the Provost's office according to established univeristy guidelines in assessing center and institutes. Particularly, in year 4 the Provost will convene a committee to assess progress of IBI, in the context of formally establishing a Department of Biomedical Informatics as a part of the planned growth trajectory. The IBI already has plans for an Informatics EAB. This report could serve a role in assessing progress on a yearly basis.

19) Letters of support from outside the University may be helpful in understanding why this change helps people beyond the University.

Response: See letter from
Michael J. Becich, MD PhD
Distinguished University Professor
Chairman, Department of Biomedical Informatics (http://www.dbmi.pitt.edu)
University of Pittsburgh School of Medicine
Associate Chancellor for Informatics for the Health Sciences
University of Pittsburgh

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1) What is the impetus for the proposed change?

Response:
Technological advances over the past 20 years led to two major shifts: an increased branching of scientific specialization, and the capture and storage of increasingly large and dense datasets, which for convenience we will call Big Data. Such shifts provide opportunities and call for a new paradigm to transform our research enterprise. Against this backdrop, the Institute will take the approach of team science in the era of Big Data to accelerate the translation of scientific discovery to societal impact.

The Institute will be a nexus for informatics research. The progressively routine acquisition of multiple different types of data in healthcare (e.g. computational genomics, proteomics; neuroscience and imaging; drug discovery and complex health modeling) has created both numerous opportunities as well as challenges in our ability to interpret and analyze such data. The emerging academic discipline of data science, covering the entire lifecycle of data collection, data curation, data annotation, data provenance, data integration, data exploration, data sharing, meaningful use, and bioinformatics analytics, has the potential to broadly-enable not only healthcare but also traditional disciplines in engineering, computational and mathematical sciences. Bold, big visions for research, embracing "open science" and capitalizing systematically collected datasets in virtually every academic disciplines and scientific domains, particularly in healthcare, will create solutions beyond reach before.

The Institute will be a catalyst for team science. Investigators from distinct disciplines with diverse backgrounds and their own scientific vocabulary, culture, and norms, must collaborate in a team setting to tackle society's vexing problems and challenges in areas such as human health. Team science enables the translation of scientific discovery to solutions that a single individual working in isolation is unlikely to provide. With its organizational structure and guiding principle grounded on team science, the Institute will bring key constituencies together at UK, including physician in hospitals, faculty in departments, administrator and staff to advance and support multi-disciplinary research. Research themes will encompass basic and applied research at the interface of genomic and life science, engineering, data science, and disease-specific areas.

The Institute will facilitate and create data science and informatics educational programs. The field of biomedical informatics is growing rapidly, and an important component of training the workforce of the future includes training the next generation of informatics specialists at all levels, including future faculty. UK needs to be a leader in this effort, especially in the state of Kentucky, and this includes the development of a training program in BMI. The development of the IBI will enable and support the efforts to create new training programs by facilitating collaborative interactions between different departments on campus. These efforts will further bridge the efforts of the Colleges of Engineering and Arts and Sciences with the Health Science Colleges into a training program that will be beneficial to all.

UK began investing in biomedical informatics in 2008 as part of the original CTSA proposal. The CTSA is the largest single grant on campus, about $20M over 5 years, and a strong informatics component is a requirement for its contiuned viability. A unique feature of our campus is that the UK biomedical campus is located side by side with the main Lexington campus—we are one University spanning the entire spectrum of academic Colleges. With the success of the CTSA proposal and the creation of the

Center for Clinical and Translational Science, we established a division of biomedical informatics and began to recruit focused research faculty. In addition, we established the UK CCTS Enterprise Data Trust (EDT) to develop clinical data as a strategic asset for researchers across UK.

However, nascent efforts across campus to develop various informatics capabilities are at risk of staying decentralized and eventually disappearing as relevant faculty are lost to competing institutions. Since the CCTS biomedical informatics effort has reached a critical mass of faculty, staff, and research infrastructure, the coordination of these resources with those across the entire University is crucial to our long-term success. The creation of the IBI will link the CCTS BMI resources to faculty and students with similar interest across campus to provide a coordinated locus of faculty, staff, and research infrastructure. The IBI will encompass activities occurring across a multitude of Colleges related to the field of biomedical informatics. Institute faculty will hold appointments in colleges throughout UK. These activities include bioinformatics (omics-focused), clinical informatics, and public health informatics. Therefore, the IBI will become a nexus for all research and scholarly activities concerning biomedical informatics and will provide health-focused informatics services, training, and education for UKHC.

Please also see Executive Summary and Introduction (**pages 1-2**) as well as Background (**pages 4-5**) of the Proposal.

2) What are the benefits and weaknesses of the proposed unit with specific emphasis on the academic merits for the proposed change?

Response:
The IBI will strive to be a center of national prominence for conducting basic and translational research spanning a spectrum of core biomedical informatics areas, with the goal of improving human health. The IBI will be a key strategic asset for UK, serving as the nexus between UKHC and academic colleges of Arts and Sciences, Engineering, Medicine, Pharmacy, and Public Health. The IBI will coordinate and harness the multidisciplinary informatics expertise, advance collaboration and team science across UK, and create and grow an innovation ecosystem with interacting elements of research, education, technology development, collaboration and dissemination. In this vision, the five main goals of IBI are:

Goal 1. To coordinate and synergize the interdisciplinary informatics expertise across UK. While silos of expertise in biomedical informatics exist at UK, lack of coordination in addressing the great need for biomedical informatics infrastructure, services, education initiatives, and clinical operation across the enterprise yields inefficient use of human and data resources, resulting in missed opportunities for some projects, and duplication of efforts on others. Strong partnerships will be forged with existing activities such as clinical informatics (Mark Williams, Cecilia Page, Carol Steltenkamp), cancer informatics (Eric Durbin), translational bioinformatics (Hunter Moseley), statistics (Arny Stromberg), computer science and engineering (Ken Calvert, Eric Grulke, Brent Seales, Jinze Liu), and public health informatics (Jeff Talbert). These partnership and collaborations will span the Colleges of Arts and Sciences, Engineering, Medicine, Pharmacy, and Public Health.

Goal 2. To utilize informatics for enhancing data-driven clinical care and operational initiatives at UKHC. The IBI staff and faculty will be involved in multiple UKHC projects

focused on improving healthcare quality, improving health outcomes and efficiency, and enhancing the linkage between clinical care and clinical research. The IBI will participate in the UKHC Data Governance Committee, collaborate with the business intelligence team, supports enterprise quality and safety initiatives, and collaborate with the Center for Health Services Research to support development of a learning healthcare system and seed new collaborative projects that support this endeavor. The IBI will also collaborate with the UKHC value-based healthcare committee to support improved coordination, shared resources, and enhanced problem-solving activities across the enterprise.

Goal 3. To expand research initiatives and strengthen research infrastructure by providing coordinated service and support through the utilization of data resources such as the Enterprise Data Trust. The UK CCTS Enterprise Data Trust (EDT) has an established regulatory framework and process across multiple data sources for researchers at the UK, including support services for data integration, data analytics, natural language processing, and honest broker services. The IBI will facilitate the access and expansion of EDT data sources and support services by the coordination of resources and shared infrastructure. Key research infrastructure collaborations includes the Center for Health Services research, the Institute for Pharmaceutical Outcomes and Policy, the Kentucky Cancer Registry, the Center for Visualization and Virtual Environments, and the Center for Computational Sciences.

Goal 4. To enhance, expand, and support informatics training programs. UK currently has several graduate certificate programs related to biomedical informatics: an Applied Statistics certificate (statistics and biostatistics), a certificate in Clinical and Translational Science (CCTS), and an Informatics certificate (computer science). To train the next generation of biomedical informatics researchers, these offerings should expand to include Masters and PhD degree programs. Computer science is currently investigating the addition of a new track in biomedical informatics that could form the basis for advanced graduate degrees and serve as core courses for doctoral research programs in medicine, translational science, and pharmacy. We recognize that this program will be a significant new venture for the Department of Computer Science, but we believe that the IBI, with associated faculty from a number of departments and colleges, will actively participate in this graduate program and significantly contribute to the development of this course material. The collective training effort and coordinated training activities are expected to serve as a basis for competing for NIH T32-like training awards in the future. We are also developing undergraduate support mechanisms to attract and prepare students for these graduate programs. These mechanisms include coordinating mentored undergraduate research experiences, providing inter-STEM course advising, supporting early under-represented minority inclusion, and developing a bioinformatics minor.

Goal 5. To develop a nationally recognized, extramurally funded research program in BMI. Through the efforts of existing and new faculty, the IBI will compete successfully for extramural grants, which will be enhanced by the collaborative efforts with other Centers and Colleges, other Universities, and interactions with UKHC.

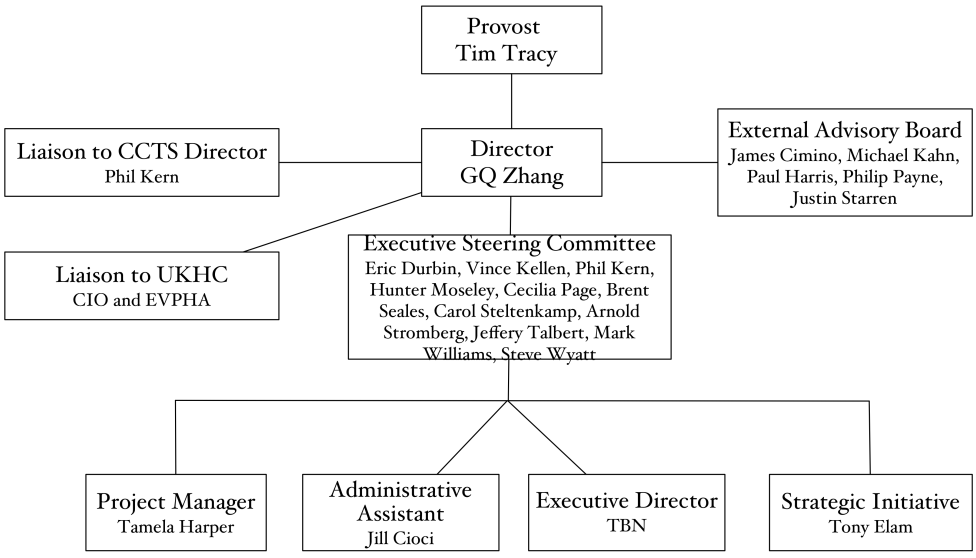
To achieve excellence in biomedical informatics, it is necessary to perform translational research, technology development, and system deployment. One of the strategic foci will be the innovation and creation of unique and cutting-edge systems, tools, and resources to empower translation research.

Please also see Vision and Goals (**pages 2-3**). No weaknesses as of now.

3) Describe the organization of the current structure and how the proposed structure will be different and better. Current and proposed organizational charts are often helpful in illustrating reporting lines.

Response:

The IBI will include leadership in the faculty and among UK administration. The IBI leadership consists of a Director, an Executive Steering Committee, two Advisory Boards, and 23 additional current members who are actively engaged in IBI work, resulting in a critical mass of persons committed to and contributing to IBI's success. At a steady state to be reached in five years, the number of primary IBI faculty members will be around 15, in line with national norm for a center of this scope. Two project managers, one from the medical campus and one from engineering, will assist the coordination of activities across the campus. An executive director will manage the administrative operations of the center. A chief technology officer will direct the design, development and update of in-house developed tools and systems. A research informatics (RI) operations manager will provide oversight on the deployment, maintenance, user interfaces and continued operation of the tools and systems.



The IBI will report to the Provost, with liaison relationships to the CCTS Director, the UKHC EVPHA, and the UKHC CIO (see reporting diagram above). The IBI will have a research, training, and clinical mission. It will also play an important outreach role with activities such as a theme pilot grant program, a seminar series, workshops and annual scientific retreats. The invitation to participate in IBI organization and governance has already been extended across the University, with the resulting broad-spread participation.

Please also see Organization (**pages 5-9**).

4) How does the change fit with department, college, and/or university objectives and priorities?

Response:
The healthcare sector is one of the largest and fastest-growing industries in this country. With the systematic adoption of electronic medical records (EMRs) and the rapid progress towards $100 sequenced genomes, life science faces a disruptive change. Increasing amounts of data are being generated from multiple sources such as EMRs, lab and imaging systems, physician notes, medical correspondence, claims and finance. Such data is growing and evolving faster than healthcare organizations can take full advantage of it. It has the potential to be utilized to empower decision-making and transform the development of new methods for disease prevention, diagnosis, prognosis, and treatment. The translation of such valuable data sets into predictable models and actionable knowledge provides unprecedented opportunities for improving healthcare delivery and outcomes, reducing the cost of care, and incentivizing well-being and a healthy lifestyle.

Informatics, a foundation for the 21st century medicine, is the key for this translation. The science of informatics drives innovation that defines future approaches to information and knowledge management in biomedical research, clinical care, and public health. Informatics researchers develop, introduce, and evaluate new methods in areas as diverse as data mining (deriving new knowledge from large databases), information retrieval, natural language processing, cognitive science, human interface design, decision support, databases, machine learning, and algorithms for analyzing large amounts of data generated in public health, clinical research, and major omics technologies (epigenomics, genomics, transcriptomics, proteomics, and metabolomics). The science of informatics is inherently interdisciplinary, drawing on (and contributing to) a large number of fields, including computer and information science, epidemiology and statistics, applied mathematics, management science, cognitive science, and organizational behavior.

Biomedical informatics units are generally based in academic medicine as stand-alone departments, but all involve interdisciplinary domains across multiple disciplines. Given the nature of the breadth and diversity of biomedical informatics expertise at the University of Kentucky, the IBI will adopt an interdisciplinary center model to coordinate and maximize the impact of developing biomedical informatics at UK. The IBI will initially be housed as a Division in the Department of Internal Medicine within the College of Medicine. Two 3-5-year milestones of this strategic plan are: (a) the establishment of a new Department of Biomedical Informatics in the College of Medicine as an expansion of IBI to a fully-fledged academic department, and (b) the establishment of a PhD degree program in Biomedical Informatics in the Department of Computer Science within the School of Engineering.

Please also see Vision and Goals (**pages 2-3**).

5) How does this change better position the proposers relative to state and national peers, as well as University Benchmark Institutions? How does the change help UK meet the goals of its strategic plan?

Response:

The University of Kentucky Strategic Plan 2015-2020 is titled "TRANSFORMING TOMORROW." In the age of information and era of big data, this transformation would not be whole without a strong data science and informatics focus.

The Strtegic Plan calls for "Continuing our commitment of the past 150 years" and "pursue multidisciplinary and interdisciplinary efforts that address challenges and disparities of our citizens and enrich their lives. Strategic support and investment will be directed toward scholarship that capitalizes on our strengths and emerging areas of growth." Biomedical informatics is exactly one such emerging area of growth, requiring multidisciplinary and interdisciplinary efforts to translate data to information to knowledge in many applied disciplines.

The support letter from Michael J. Becich, MD PhD, Distinguished University Professor and Chairman, *Department of Biomedical Informatics*, Associate Chancellor for Informatics for the Health Sciences at University of Pittsburgh attests that

> ***Biomedical informatics has been a strategic and growing area across the country for over a decade. This growth is intensifying, driven by many factors that include national initiatives such as Big Data, Precision Medicine, and Leaning Healthcare Systems. As the commenweath's flagship institution and leader in the state of Kentucky for academic medicine and healthcare, the establishment of the Institute of Biomedical Informatics is strategically important and timely for the University of Kentucky.***

Please also see Sample IBI Initiatives (**pages 12-13**).

6) Who are the key personnel associated with the proposed unit? Provide qualifications of these personnel in a brief form. A complete curriculum vitae for each person is not needed, although pertinent information in tabular format is helpful.

Response:

The IBI will report to the Provost, with liaison relationships to the CCTS Director, the UKHC EVPHA, and the UKHC CIO. The IBI will have a research, training, and clinical mission. It will also play an important outreach role with activities such as a theme pilot grant program, a seminar series, workshops and annual scientific retreats. The invitation to participate in IBI organization and governance has already been extended across the University, with the resulting broad-spread participation.

Director: GQ Zhang, PhD, Biomedical Informatics and Data Science
Zhang has been recruited to UK for senior biomedical informatics leadership roles as part of University of Kentucky's (UK) enhanced commitment to Informatics. He is Professor and Chief of the Division of Biomedical Informatics in the College of Medicine. He serves as the Director of the Biomedical Informatics Core for CCTS. Zhang's research theme spans large-scale, multi-center data integration, biomedical ontology development, query interface design and information retrieval, and agile, interface-driven access-control grounded software development. During the past 10 years, he led a group that developed over a dozen
clinical research informatics tools for data capturing, data management, cohort discovery, such as Physio-MIMI/VISAGE, MEDCIS, OnWARD, OPIC, EpiDEA, and

Cloudwave. He is the PI of two large-scale national data resource projects. One is the National Sleep Research Resource (R24HL114473; https://sleepdata.org), to establish a comprehensive, easily accessible and well-annotated, retrospectively integrated, national repository of sleep data. This big data resource will consist of more than 15 completed R01 and multi-center sleep studies sponsored by NHLBI. It comes with embedded IRB and Data Use Agreement processes to make
it easier for researchers to reuse data that has already been collected but there is no other simple way to access it. The second is the data and informatics core (U01NS090408) for the Center for SUDEP Research (CSR), a NINDS-funded Center Without Walls for Collaborative Research in the Epilepsies. The CSR is a collaborative of 14 institutions across the United States and Europe, to bring together extensive and diverse expertise to understand Sudden Unexpected Death in Epilepsy Patients (SUDEP). This core manages the entire data pipeline for CSR, prospectively capturing, managing, curating and integrating rich multi-modal clinical data collected from epileptic patients in participating CSR sites.

Executive Steering Committee Members:

Eric Durbin, DrPH, Cancer Informatics
Durbin is Assistant Professor, Division of Biomedical Informatics, Director Cancer Research Informatics Shared Resource Facility of the Markey Cancer Center CCSG. He is also the Director of Cancer Informatics at the NCI/SEER Kentucky Cancer Registry (KCR). He has over 24 years of experience in population-based cancer surveillance and informatics support for basic, clinical and population-based cancer research. Durbin led the international efforts for the North American Association of Central Cancer Registries to establish Health Level Seven (HL7) standards for electronic pathology reporting to cancer registries. He has developed one of the most comprehensive electronic cancer surveillance infrastructures in the U.S. and led KCR to become the first central cancer registry to achieve electronic cancer reporting under Meaningful Use Stage 2. His research interests include electronic disease surveillance, pathology informatics, natural language processing, data standards, and cancer epidemiology.

Vince Kellen, PhD, IT and Computing Infrastructure
Kellen is the Senior Vice Provost for Analytics & Technologies. Kellen brings a combination of business, academic and IT architecture experience to his role, with a focus on transformational leadership within IT. Since 1998, he has served as a faculty member and has taught graduate and undergraduate courses on IT and strategy, enterprise architecture, and information systems. In his role, Kellen leads a staff of 275 supporting 28,000 students, 18 colleges, and 13,000 employees, and manages the planning of and support for IT strategic planning, enterprise software, high performance computing, learning spaces, classroom technology, learning management systems, business intelligence, student information systems, data center operations, network infrastructure, distance learning, and information technology support.

Phil Kern, MD, Clinical and Translational Science
Kern's leadership positions include the directorship of the Center for Clinical and Translational Science (CCTS) and Associate Provost for Clinical and Translational Science. The mission of the CCTS is to stimulate innovative translational science on campus, promote development of the translational workforce, stimulate team science, work with the healthcare system to develop efficiencies and improved strategies for translational research, build a clinical trials network and generally serve as a nexus at

UK and in the Central Appalachian region for research that improves health in the community. Kern has a long history of studying adipocyte biology and metabolism. He is engaged in both basic and clinical research related to obesity, metabolic syndrome, diabetes and insulin resistance.

Hunter Moseley, PhD, Translational Informatics
Moseley is Associate Professor in the Department of Molecular and Cellular Biochemistry and Associate Director of Informatics for the Resource Center for Stable Isotope Resolved Metabolomics. Moseley's education spans multiple disciplines including chemistry, mathematics, computer science and biochemistry and has over 20 years of experience in bioinformatics research, particularly in the development of automated analyses of NMR and mass spectrometry data. This includes extensive expertise in algorithm development, mathematical modeling, and metabolic biochemistry. His lab is actively developing informatics techniques for metabolomics and methods to integrate metabolomics data with other omics-level datasets for systems level analyses that can be applied to the investigation of specific human diseases.

Cecilia Page, Director of Clinical Informatics, UK HealthCare
Page has experienced over 20+ years of senior leadership positions in Nursing spanning various levels of management in several organizations up to Chief Nursing Officer, Consultant, and Vice President for Clinical Systems Integration.

Carol Steltenkamp, MD, MBA, Electronic Health Records, Data Governance
Steltenkamp's efforts throughout Kentucky include co-chairing the eHealth Network Board and directing the Kentucky Regional Extension Center. She established partnerships across the state and gained credibility with legislators in the realm of public policy. She has served on multiple regional and national boards and is currently chair of the Health Information Management Systems Society International Board of Managers. She has successfully led large-scale implementations of electronic health records and has a reputation as a national leader in the use of computerized physician order entry.

Mark Williams, MD, FACP, MHM, Hospital Medicine
Williams serves as Professor and Vice-Chair of the Department of Internal Medicine, and acting Chief of the Division of Hospital Medicine at the University of Kentucky. After graduating from Emory University School of Medicine, he completed a residency in internal medicine at Massachusetts General Hospital. Dr. Williams established the first hospitalist program at a public hospital in 1998, and built two of the largest academic hospitalist programs in the U.S. at Emory (1998-2007) and Northwestern Universities (2007-2013). A Past President of the Society of Hospital Medicine and the Founding Editor of the Journal of Hospital Medicine, he actively promotes the role of hospitalists as leaders in delivery of health care to hospitalized patients. He serves as PI for SHM's Project BOOST (Better Outcomes by Optimizing Safe Transitions). With previous funding from The Robert Wood Johnson Foundation, The John A. Hartford Foundation, Aetna Foundation, California Health Care Foundation, NIND, HHS, AHRQ, BlueCross BlueShield of Illinois, and PCORI and more than 100 peer-reviewed publications including in journals such as JAMA, New England Journal of Medicine, and Annals of Internal Medicine, Dr. Williams' research focuses on quality improvement, care transitions, teamwork and the role of health literacy in the delivery of health care.

Brent Seales, PhD, Computer Science

Seales is Professor and Chair of the Department of Computer Science, College of Engineering. His research focuses on digital imaging in two very different directions: medical imaging and cultural heritage. His EDUCE project (Enhanced Digital Unwrapping for Conservation and Exploration) seeks to create readable images of texts such as papyrus
scrolls, without opening them, using minimally invasive scanning and virtual unwrapping. Seales is developing and evaluating new techniques for digital acquisition, restoration, and visualization using real-world library collections with particular focus on preservation and dissemination. He is also the director of the STITCH project (Surgical Technology Integration with Tools for Cognitive Human Factors), which envisions a networked operating room of the future, where computers and surgical instruments are connected.

Arnold Stromberg, PhD, Bioinformatics/Biostatistics
Stromberg is Professor and Chair, Department of Statistics and Co-Director Statistical Computer Modeling for Bioinformatics Core of the CCTS. Stromberg's expertise is distributed computation and data analysis using supercomputers. As part of INBRE, he provides statistical expertise with DNA microarray data analysis and continues to develop innovative methods of statistical analysis for microarray data. His paper on pooling microarray data is among the ten most downloaded papers in BMC Bioinformatics. He recently served on the university committee that selected the new IBM supercomputer. He directs data analysis for the UK Microarray Core Facility. Stromberg's theoretical and applied background in outlier identification is useful for scanning data for anomalies.

Jeffery Talbert, PhD, Public Health Informatics and EDT
Talbert is Professor in the Department of Pharmacy Practice and Science, Director of the Institute for Pharmaceutical Outcomes and Policy, Co-Director of Biomedical Informatics, and Associate Director of the Center for Health Services Research. Talbert has over 20 years experience in health research focused on the intersection of policy decisions and health outcomes, including serving as a research fellow for the US Congress, as a faculty member in Public Policy, Public Health, and Pharmacy. Professor Talbert has research interests in pharmaceutical policy, Medicaid policy, and public health informatics. His current research program focuses on two areas: improving health outcomes and efficiency for state Medicaid programs, and policy issues related to reducing prescription drug abuse and diversion.

Stephen Wyatt, MPH, DMD,
Wyatt serves as the Senior Associate Director for the University of Kentucky (UK) CCTS, guiding the Administrative Core and providing oversight (Co-Project Lead) to the critical ATRN Optional Function. His professional background at the CDC and UK has provided significant experience in the development, growth and maturation of complex organizations. A significant area of campus engagement during my his years of service as an academic unit Dean at UK
(College of Public Health) was Team Science promotion, including the nurturing/development of multidisciplinary research teams and policies that recognize and reward team science in the tenure/promotion process. He also serves as Vice President for Research at Norton Healthcare in Louisville, KY. This role importantly connects UK, UK Healthcare and the CCTS to the largest healthcare delivery entity in the Commonwealth, providing significant opportunities for research collaboration and access to a diverse urban population.

External Advisory Board (To be confirmed): Justin Starren, James Cimino, Philip Payne, Paul Harris, Michael Kahn

Project Managers: Tamela Harper

Strategic Initiative: Tony Elam

Membership

Below is a partial list of faculty who currently participate in Informatics activities on campus, and who we expect to have an affiliation with IBI, grouped according to expertise:

Molecular and Cellular Processes
Sivakumaran Arumugam
David Fardo
Hunter Moseley
Radha Nagarajan
Arnold Stromberg
Chi Wang
Jinze Liu
David Murragarra

Computing Systems
Ken Calvert
Vince Kellen
Rama Kavuluru

High Performance Computing
Licong Cui
Sally Ellingston
Eric Grulke

Imaging Informatics
Brent Seales

Clinical and Public Health Informatics
Licong Cui
Eric Durbin
Tamas Gall
Isaac Hands
Bin Huang
Tom Kelly
Sujin Kim
Daniel Harris
Darren Henderson
Radha Nagarajan
Cecilia Page
Carol Steltenkamp
Jeffery Talbert
Tom Tucker

Heidi Weiss
Mark Williams

Education
Eric Grulke
Jerzy Jaromczyk
Tom Kelly
Hunter Moseley
Mirek Truszczynski

Please also see Organization (**pages 5-9**).

7) Discuss leadership and selection process for appointing a chair, a director, or interim leader and search process, etc.

Response: The selection of IBI's inaugural director is a result of an extensive search process over the past two years. The search committee, chaired by **Drs. Phil Kern and Jeffery Talbert**, clarified the attributes an individual must possess to develop biomedical informatics at the University of Kentucky and worked to recruit such a leader. Dr. GQ Zhang, a leading biomedical scientist from Case Western Reserve University was succeffuly recruited to fill this role.

8) What is the function of the faculty/staff associated with the proposed change and how is that relationship defined? Discuss DOE, adjunct, full-time, voting rights, etc.

Response: The primary faculty of IBI will be faculty in the Division of Biomedical Informatics. They will function as a typical faculty, governed by the standard College of Medicine roles, policies and procedures for a division and departmnent.

A faculty member from the IBI with primary appointment in e.g., the Department of Computer Science and secondary appointment in the Divisionof Biomedical Informatics will have their teaching and service duties administrated through the Department of Computer Science, and research activities coordinated through the Division of Biomedical Informatics, under the overall umbrella of IBI.

Please also see **Response to 11.**

9) Will the proposed change involve multiple schools or colleges?

Response: Not at this point, but once IBI is established, memership in the IBI will include, but not limited to the faculty listed on **pages 6-10** of the proposal. Before the establishment, memership in IBI cannot be formalized.

10) If the proposed change will involve transferring personnel from one unit to another, provide evidence that the donor unit is willing and able to release the personnel.

Response: The formal transfer of 5 faculty members (Eric Durbin, Sally Ellingston, Rama Kavuluru, Sujin Kim, Radha Nagarajan) from College of Public Health to the College of Medicine **was completed in November, 2015.**

11) What is the arrangement of faculty associated with the proposed change and how is that relationship defined? Discuss faculty DOE and status as adjunct, tenure track, or tenured. Describe the level of faculty input in the policy-making process including voting rights and advisory.

Response:

- **Tenured**: GQ Zhang (Professor and Diretor), Radha Nagarajan (Associate Professor), Sujin Kim (Associate Professor);
- **Tenture Track**: Rama Kavuluru (Assistant Professor)
- **Research Assistant Professor:** Licong Cui, Eric Durbin, Sally Ellingston.

The DOE of each faculty appears in the table below.

Name	Research	Teaching	Service	Professional Devlopment
Cui	90	0	0	5
Durbin	90	0	0	5
Ellingston	90	0	0	5
Kavuluru	65	15	15	5
Kim*	35	45	15	5
Nagarajan	65	15	15	5
Zhang	50	15	30	5

*: Dr. Kim has 30% DOE for teaching supported by College of Communication & Information.

The level of faculty input in the policy-making process including voting rights and advisory roles are governed by the existing College of Medicine's roles, policies and procedures for a division and departmnent.

12) Discuss any implications of the proposal for accreditation by SACS and/or other organizations.

Response: It could potentially enhance the accreditation of degree programs such as Computer Science.

13) What is the timeline for key events in the proposed change? Student enrollments, graduates, moved programs, closed courses, new faculty and staff hires, etc.

Response: Three new staff members have already been hired. A total of 4 new faculty hires are planned in the next couple of years. Advertisement for 2 faculty positions has been placed for fall 2016. A biomedical informatics track is been revitalized in Computer Science. The existing BMI courses offered in the College of Public Health are to be reexamined and transferred to the College of Medicine in Spring 2016.

14) If the proposal involves degree changes, describe how the proposed structure will enhance students' education and make them more competitive. Discuss the impact on

current and future students. State assumptions underlying student enrollment growth and describe the plans for student recruitment.

Response: NA

15) Include evidence that adequate financial resources exist for the proposed unit to be viable. A general description of the new costs and funding should be provided. A letter from the Provost, Dean, or other relevant administrators may affirm commitment to provide financial resources as appropriate. An exhaustive budget is not expected.

Response:
No new funds are requested as a part of this Strategic Plan at this point. Main funds for operational and recurring support fall into the following categories:

- Recurring
    - 5 state faculty lines (recurring)
    - insititutional support ($1.5M) from the CCTS, Provost, College of Medicine, and UK HealthCare
- Non-recurring
    - new faculty startup funds ($1.5M, part of Zhang's startup)
    - new faculty salary support ($2.0M, part of Zhang's startup)
    - staff support ($1.2M, part of Zhang's startup)
    - computational equipment ($250K, part of Zhang's startup)
- Main extramurally funded centers (transferring to UK)
    - NINDS: Informatics and Data Analytics Core for Center for SUDEP Research (5U01NS090408, PI Zhang), ~$770K annually, 2015-2019
    - NHLBI: National Sleep Research Resource (R24HL114473, MPI Zhang), ~$250K annually, 2015-2018

Please also see **page 12.**

16) The proposal should document any faculty votes and departmental or school committee votes as appropriate leading up to this point in the process. The SAOSC recommends that faculty votes be by secret ballot. Include in your documentation of each vote taken the total number of eligible voters and the number that actually voted along with the break-down of the vote into numbers for, against and abstaining. A Chair or Dean may appropriately summarize supporting and opposing viewpoints expressed during faculty discussions.

Response: To help achieving its mission and goals, the IBI is planned to be an entity that transcends individual colleges and departments. In order for the IBI to help address a campus need to engage faculty from multiple academic units in research, service and education efforts, the IBI proposed reporting line is to the Provost, positioning the IBI to help meet that need.

The planning of the IBI has sought support from leaders from multiple colleges. Please **see support letters from the deans of the College of Engineering, College of Public Health, and College of Phamacy**.

17) The committee will want to see evidence of academic merit and support from key parties. Letters of support (or opposition) are encouraged from the relevant senior faculty

and administrators. Relevant faculty and administrators include those in units directly involved in the proposed change (including existing units from which a new unit may be formed.)

Response: **Please see attached support letters from the deans of Engineering, Publich Health, Phamacy as well as the earlier letter from CCTS director**.

18) Indicate how the new structure will be evaluated as to whether it is meeting the objectives for its formation. Timing of key events is helpful.

Response: The IBI will be reviewed and evaluated by the Provost's office according to established univeristy guidelines in assessing center and institutes. Particularly, **in year 4 the Provost will convene a committee to assess progress of IBI, in the context of formally establishing a Department of Biomedical Informatics** as a part of the planned growth trajectory. The IBI already has plans for an Informatics EAB. This report could serve a role in **assessing progress on a yearly basis**.

19) Letters of support from outside the University may be helpful in understanding why this change helps people beyond the University.

Response: See letter from
Michael J. Becich, MD PhD
Distinguished University Professor
Chairman, Department of Biomedical Informatics (http://www.dbmi.pitt.edu)
University of Pittsburgh School of Medicine
Associate Chancellor for Informatics for the Health Sciences
University of Pittsburgh

A Strategic Plan for the University of Kentucky Institute for Biomedical Informatics

April 25, 2016

Executive Summary. The mission for the Institute for Biomedical Informatics (IBI) is to translate data to knowledge with the goal to improve human health and effectively use the latest technology and tools for the advancement of biological sciences. This mission is fulfilled through the development of research, training, UK HealthCare (UKHC) informatics integration and community engagement programs spanning areas such as translational bioinformatics, clinical informatics, research informatics, and public health informatics. A core group of problem-solving faculty leaders will be developed to address the ever-changing and mission-critical data science challenges facing the UK research enterprise. The IBI will promote translational team science and engage the entire UK campus to develop and grow informatics and data science training programs, share research and data infrastructure, and enable technology innovation.

Introduction

The healthcare sector is one of the largest and fastest-growing industries in this country. With the systematic adoption of electronic medical records (EMRs) and the rapid progress towards $100 genome, life science faces a disruptive change. Increasing amounts of data are being generated from multiple sources such as EMRs, lab and imaging systems, physician notes, medical correspondence, claims and finance. Such data is growing and evolving faster than healthcare organizations can take full advantage of it. It has the potential to be utilized to empower decision-making and transform the development of new methods for disease prevention, diagnosis, prognosis, and treatment. The translation of such valuable data sets into predictable models and actionable knowledge provides unprecedented opportunities for improving healthcare delivery and outcomes, reducing the cost of care, and incentivizing wellbeing and a healthy lifestyle.

Informatics, a foundation for the 21st century medicine, is the key for this translation. The science of informatics drives innovation that defines future approaches to information and knowledge management in biomedical research, clinical care, and public health. Informatics researchers develop, introduce, and evaluate new methods in areas as diverse as data mining (deriving new knowledge from large databases), information retrieval, natural language processing, cognitive science, human interface design, decision support, databases, machine learning, and algorithms for analyzing large amounts of data generated in public health, clinical research, and genomics/proteomics. The science of informatics is inherently interdisciplinary, drawing on (and contributing to) a large number of fields, including computer science, epidemiology and statistics, information science, management science, cognitive science, and organizational behavior.

Biomedical informatics units are generally based in academic medicine as stand-alone departments, but all involve interdisciplinary domains across multiple disciplines. Given the nature of the breadth and diversity of biomedical informatics expertise at the University of Kentucky, the IBI will adopt an interdisciplinary center model to coordinate and maximize the impact of developing biomedical informatics at UK. In concert with the establishment of IBI, two medium-term milestones of this strategic plan are: (a) assessing and planning for the possible

establishment of a new Department of Biomedical Informatics in the College of Medicine, and (b) the development and possible creation of graduate degree programs in Biomedical Informatics in collaboration with the Department of Computer Science in the College of Engineering.

Vision and Goals

Vision. The IBI will be a center of national prominence for conducting basic and translational research spanning a spectrum of core biomedical informatics areas, with the goal of improving human health. The IBI will be a key strategic asset for UK, serving as the nexus between UKHC and academic colleges of Arts and Sciences, Engineering, Medicine, Pharmacy, and Public Health. The IBI will coordinate and harness the multidisciplinary informatics expertise, advance collaboration and team science across UK, and create and grow an innovation ecosystem with interacting elements of research, education, technology development, collaboration and dissemination. In this vision, the five main goals of IBI are:

Goal 1. To coordinate and synergize the interdisciplinary informatics expertise across UK.
While silos of expertise in biomedical informatics exist at UK, lack of coordination and the great need for biomedical informatics infrastructure, services, education initiatives, and clinical operation across the enterprise yields inefficient use of data resources, resulting in missed opportunities for some projects, and duplication of efforts on others. Strong partnerships have been forged with existing activities such as clinical informatics (Mark Williams, Cecilia Page, Carol Steltenkamp), cancer informatics (Eric Durbin), translational bioinformatics (Hunter Moseley), statistics (Arny Stromberg), computer science and engineering (Ken Calvert, Eric Grulke, Brent Seales, and Jinze Liu), agriculture (Mark Farman and Jamie MacLeod), dentistry (Jeff Ebersole and Gregory Zeller) and public health informatics (Jeff Talbert). These partnership and collaborations will span the Colleges of Agriculture, Food and Environment; Arts & Sciences; Dentistry; Engineering; Medicine; Pharmacy; and Public Health.

Goal 2. To utilize informatics for enhancing data-driven clinical care and operational initiatives at UKHC.
The IBI staff and faculty will be involved in multiple UKHC projects focused on improving healthcare quality, improving health outcomes and efficiency, and enhancing the linkage between clinical care and clinical research. The IBI will participate in the UKHC Data Governance Committee, collaborate with the business intelligence team, supports enterprise quality and safety initiatives, and collaborate with the Center for Health Services Research to support development of a learning healthcare system. The IBI will also collaborate with the UKHC value-based healthcare committee to support improved coordination, shared resources, and enhanced problem-solving activities across the enterprise.

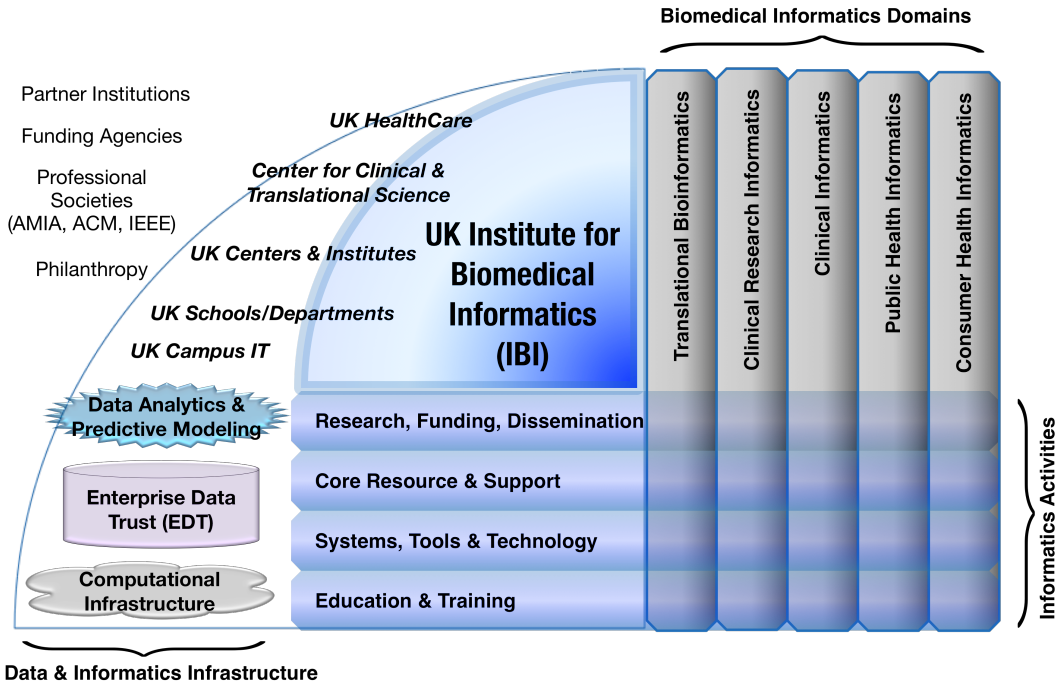
Goal 3. To expand research initiatives and strengthen research infrastructure by providing coordinated service and support through the utilization of data resources such as the Enterprise Data Trust.
The UK CCTS Enterprise Data Trust (EDT) has an established regulatory framework and process across multiple data sources for researchers at the UK, including support services for data integration, data analytics, natural language processing, and honest broker services. The IBI will facilitate the access and expansion of EDT data sources and support services by the coordination of resources and shared infrastructure. Key research infrastructure collaborations includes the Center for Health Services research, the Institute for Pharmaceutical Outcomes

and Policy, the Kentucky Cancer Registry, the Center for Visualization and Virtual Environments, and the Center for Computational Sciences.

Goal 4. To streamline, enhance, and expand informatics training programs.
UK currently has several graduate certificate programs related to biomedical informatics: an Applied Statistics certificate (statistics and biostatistics), a certificate in Clinical and Translational Science (CCTS), and an Informatics certificate (computer science). To train the next generation of biomedical informatics researchers, these offerings should expand to include Masters and PhD degree programs. Computer science is investigating the addition of a new track in biomedical informatics that could form the basis for advanced graduate degrees and serve as core courses for doctoral research programs in medicine, translational science, and pharmacy. We believe that the IBI, with associated faculty from a number of departments and colleges, will actively participate in this graduate program and significantly contribute to the development of the course material. The collective training effort and coordinated training activities are expected to serve as a basis for competing for NIH T32/15-like training awards in the future.

Goal 5. To develop a nationally recognized, extramurally funded research program in BMI.
Through the efforts of existing and new faculty, the IBI will compete successfully for extramural grants, which will be enhanced by the collaborative efforts with other Centers and Colleges, other Universities, and interactions with UKHC.

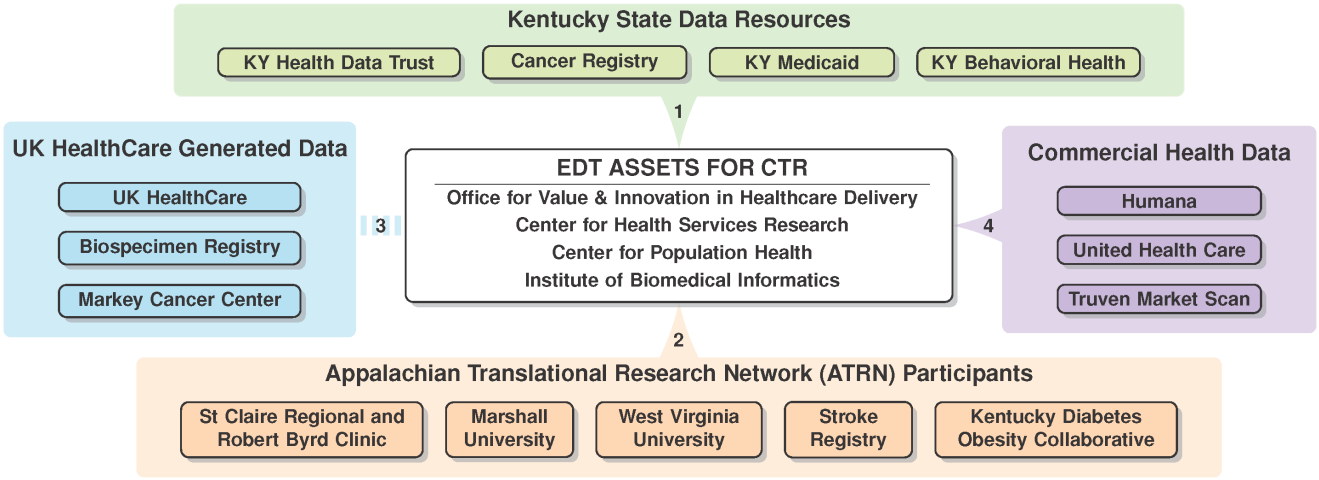
To achieve excellence in biomedical informatics, it is necessary to perform translational research, technology development, and system deployment. One of the strategic foci will be the innovation and creation of unique and cutting-edge systems, tools and resources to empower translation research. The disciplinary foci, core informatics activities and infrastructure support, and their relationships are captured in the diagram below.



Background

UK began investing in biomedical informatics in 2008 as part of the original CTSA proposal. A unique feature of this campus is that the UK health campus is located side by side with the main Lexington campus—we are one University spanning the entire spectrum of academic Colleges. With the CTSA award and the creation of the Center for Clinical and Translational Science (CCTS), we established a division of biomedical informatics and began to recruit focused research faculty. In addition, we established the UK CCTS Enterprise Data Trust (EDT) to develop a clinical data warehouse as a strategic asset to enable research across UK.

The EDT integrates UKHC clinical systems into a centralized warehouse of clinical and administrative data. The warehouse serves operational roles for UKHC reporting and is governed by UKHC Information Technology committees and the UKHC Office of Corporate Compliance, and the UK Office of Research Integrity. De-identified data is available to researchers via i2b2 and identified data through IRB approved protocols. The EDT also licenses additional datasets with external partners, and these are made available to researchers. Datasets include: United Healthcare de-identified claims data, Humana de-identified clinical data, Healthcare Cost & Utilization Project (HCUP), University Health-System Collaborative (UHC), Kentucky Medicaid Claims Data, Kentucky Diabetes & Obesity Collaborative (KDOC), Social Security Death Master File, Marshall de-identified clinical data, and Appalachian Patient Stroke Recovery and Research Registry (see diagram below).



The CCTS EDT data network. Center: the translational research centers that CCTS helped create. Above: Kentucky state data available for research (see section III for details). Right: licensed commercial health data available for research. Left: UK HealthCare-generated data feeds into the research centers with data generated from the research centers integrated back, creating a two-way information flow (dotted connection). Bottom: regional network of ATRN collecting unique health disparity data for research. Unidirectional (1,2,4) and bidirectional (3) data flow exist in the EDT.

The field of health informatics is growing rapidly, and an important component of training the workforce of the future includes training the next generation of informatics specialists at all levels, including future faculty. UK needs to be a leader in this effort, especially in the state of Kentucky, and this includes the development of a training program in BMI. The development of the IBI will facilitate efforts to create new training programs by promoting collaborative interactions between different departments on campus. These efforts will further bridge the

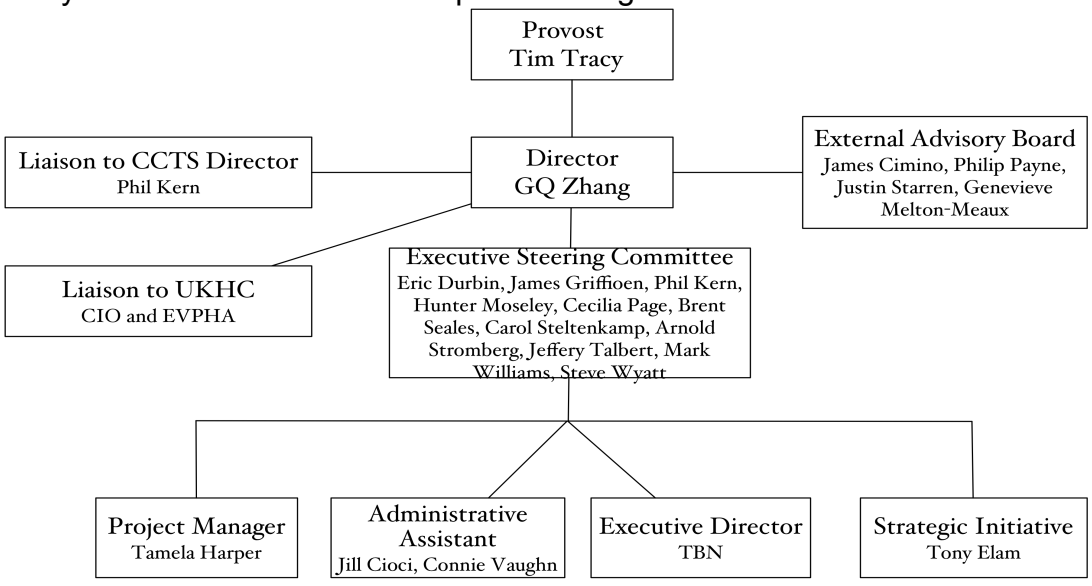
efforts of the Colleges of Engineering and Arts and Sciences with the Health Science Colleges into a training program that will be beneficial to all.

However, nascent efforts across campus to develop various informatics capabilities are at risk of staying decentralized and eventually disappearing as relevant faculty are lost to competing institutions, if no action is taken. Since the CCTS biomedical informatics effort has reached a critical mass of faculty, staff, and research infrastructure, the coordination of these resources with those across the entire University is crucial to our long-term success. ***The creation of the IBI will link the CCTS BMI resources to faculty and students with similar interest across campus to provide a coordinated locus of faculty, staff, and research infrastructure***. The IBI will encompass activities occurring across a multitude of Colleges related to the field of biomedical informatics. Center faculty will hold appointments in colleges throughout UK. These activities include bioinformatics (omics-focused), clinical informatics, and public health informatics. Therefore, the IBI will become a nexus for all research and scholarly activities concerning biomedical informatics and will provide health-focused informatics services, training, and education for UKHC.

Governance

The IBI will include leadership in the faculty and among UK administration. The IBI leadership consists of a Director, an Executive Steering Committee, two Advisory Boards, and additional current members who are actively engaged in IBI work, resulting in a critical mass of persons committed to and contributing to IBI's success. In accordance with GR VII.para. 1, the time equivalence assigned to the faculty to perform instruction, research and service in the IBI will cumulate to at least one FTE.

At a steady state to be reached in five years, the number of primary IBI faculty members will be around 15, in line with national norm for a center of this scope. Two project managers, one from the medical campus and one from engineering, will assist the coordination of activities across the campus. An executive director will manage the administrative operations of the center. A chief technology officer will direct the design, development and update of in-house developed tools and systems. A research informatics (RI) operations manager will provide oversight on the deployment, maintenance, user interfaces and continued operation of the tools and systems. The initial leadership and an organizational chart are shown below.



The IBI will report to the Provost, with liaison relationships to the CCTS Director, the UKHC EVPHA, and the UKHC CIO. The IBI will have a research, training, and clinical mission. It will also play an important outreach role with activities such as a theme pilot grant program, a seminar series, workshops and annual scientific retreats. The invitation to participate in IBI organization and governance has already been extended across the University, with the resulting broad-spread participation (see partial list, page 9).

Director: GQ Zhang, PhD, Biomedical Informatics and Data Science
Zhang has been recruited to UK for senior biomedical informatics leadership roles as part of University of Kentucky's (UK) enhanced commitment to Informatics. He is Professor and Chief of the Division of Biomedical Informatics in the College of Medicine. He serves as the Director of the Biomedical Informatics Core for CCTS. Zhang's research theme spans large-scale, multi-center data integration, biomedical ontology development, query interface design and information retrieval, and agile, interface-driven access-control grounded software development. During the past 10 years, he led a group that developed over a dozen clinical research informatics tools for data capturing, data management, cohort discovery, such as Physio-MIMI/VISAGE, MEDCIS, OnWARD, OPIC, EpiDEA, and Cloudwave. He is the PI of two large-scale national data resource projects. One is the National Sleep Research Resource (R24HL114473; https://sleepdata.org), to establish a comprehensive, easily accessible and well-annotated, retrospectively integrated, national repository of sleep data. This big data resource will consist of more than 15 completed R01 and multi-center sleep studies sponsored by NHLBI. It comes with embedded IRB and Data Use Agreement processes to make it easier for researchers to reuse data that has already been collected but there is no other simple way to access it. The second is the data and informatics core (U01NS090408) for the Center for SUDEP Research (CSR), a NINDS-funded Center Without Walls for Collaborative Research in the Epilepsies. The CSR is a collaborative of 14 institutions across the United States and Europe, to bring together extensive and diverse expertise to understand Sudden Unexpected Death in Epilepsy Patients (SUDEP). This core manages the entire data pipeline for CSR, prospectively capturing, managing, curating and integrating rich multi-modal clinical data collected from epileptic patients in participating CSR sites.

Executive Steering Committee Members (to be finalized):

Eric Durbin, DrPH, Cancer Informatics
Durbin is Assistant Professor, Division of Biomedical Informatics, Director for Cancer Research Informatics Shared Resource Facility of the Markey Cancer Center CCSG. He is also the Director of Cancer Informatics at the NCI/SEER Kentucky Cancer Registry (KCR). He has over 24 years of experience in population-based cancer surveillance and informatics support for basic, clinical and population-based cancer research. Durbin led the international efforts for the North American Association of Central Cancer Registries to establish Health Level Seven (HL7) standards for electronic pathology reporting to cancer registries. He has developed one of the most comprehensive electronic cancer surveillance infrastructures in the U.S. and led KCR to become the first central cancer registry to achieve electronic cancer reporting under Meaningful Use Stage 2. His research interests include electronic disease surveillance, pathology informatics, natural language processing, data standards, and cancer epidemiology.

James Griffioen, PhD, IT and Computing Infrastructure

Griffioen is Professor of Computer Science in the College of Engineering. He is the Director of the UK Center for Computational Sciences, and Director of the Laboratory for Advanced Networking. He received his Ph.D. in Computer Science from Purdue University and has over 20 years of research and educational experience in distributed computing system and networking. Over the past 4 years, he developed, and has been primarily responsible for, a new gateway course in the Computer Science Department called Systems Programming that provides students with a comprehensive overview of all the components that affect a software application including computer architecture, compilers, libraries, operating systems, storage systems, and networks. His relevant research in cloud computing includes work on distributed operating system designs, distributed/parallel processing of digital images, multimedia systems, programmable networks, network protocol design, future internet architectures, and distributed testbed tools and services. Recently his efforts have focused on scalability, including the development of software tools and services that make it easy to monitor and measure network and distributed system performance in large scale systems. As Director of the Center for Computational Sciences, he is responsible for supporting the computational research needs of faculty, staff, and students at the University of Kentucky, including offering specialized training and domain expertise.

Phil Kern, MD, Clinical and Translational Science
Kern's leadership positions include the directorship of the Center for Clinical and Translational Science (CCTS) and Associate Provost for Clinical and Translational Science. The mission of the CCTS is to stimulate innovative translational science on campus, promote development of the translational workforce, stimulate team science, work with the healthcare system to develop efficiencies and improved strategies for translational research, build a clinical trials network and generally serve as a nexus at UK and in the Central Appalachian region for research that improves health in the community. Kern has a long history of studying adipocyte biology and metabolism. He is engaged in both basic and clinical research related to obesity, metabolic syndrome, diabetes and insulin resistance.

Hunter Moseley, PhD, Translational Informatics
Moseley is Associate Professor in the Department of Molecular and Cellular Biochemistry and Associate Director of Informatics for the Resource Center for Stable Isotope Resolved Metabolomics. Moseley's education spans multiple disciplines including chemistry, mathematics, computer science and biochemistry and has over 20 years of experience in bioinformatics research, particularly in the development of automated analyses of NMR and mass spectrometry data. This includes extensive expertise in algorithm development, mathematical modeling, and metabolic biochemistry. His lab is actively developing informatics techniques for metabolomics and methods to integrate metabolomics data with other omics-level datasets for systems level analyses that can be applied to the investigation of specific human diseases.

Cecilia Page, Director of Clinical Informatics, UK HealthCare
Page has experienced over 20+ years of senior leadership positions in Nursing spanning various levels of management in several organizations up to Chief Nursing Officer, Consultant, and Vice President for Clinical Systems Integration.

Carol Steltenkamp, MD, MBA, Electronic Health Records, Data Governance
Steltenkamp's efforts throughout Kentucky include co-chairing the eHealth Network Board and directing the Kentucky Regional Extension Center. She established partnerships across the

state and gained credibility with legislators in the realm of public policy. She has served on multiple regional and national boards and is currently chair of the Health Information Management Systems Society International Board of Managers. She has successfully led large-scale implementations of electronic health records and has a reputation as a national leader in the use of computerized physician order entry.

Mark Williams, MD, FACP, MHM, Hospital Medicine
Williams serves as Professor and Vice-Chair of the Department of Internal Medicine, and acting Chief of the Division of Hospital Medicine at the University of Kentucky. After graduating from Emory University School of Medicine, he completed a residency in internal medicine at Massachusetts General Hospital. Dr. Williams established the first hospitalist program at a public hospital in 1998, and built two of the largest academic hospitalist programs in the U.S. at Emory (1998-2007) and Northwestern Universities (2007-2013). A Past President of the Society of Hospital Medicine and the Founding Editor of the Journal of Hospital Medicine, he actively promotes the role of hospitalists as leaders in delivery of health care to hospitalized patients. He serves as PI for SHM's Project BOOST (Better Outcomes by Optimizing Safe Transitions). With previous funding from The Robert Wood Johnson Foundation, The John A. Hartford Foundation, Aetna Foundation, California Health Care Foundation, NIND, HHS, AHRQ, BlueCross BlueShield of Illinois, and PCORI and more than 100 peer-reviewed publications including in journals such as JAMA, New England Journal of Medicine, and Annals of Internal Medicine, Dr. Williams' research focuses on quality improvement, care transitions, teamwork and the role of health literacy in the delivery of health care.

Brent Seales, PhD, Computer Science
Seales is Professor and Chair of the Department of Computer Science, College of Engineering. His research focuses on digital imaging in two very different directions: medical imaging and cultural heritage. His EDUCE project (Enhanced Digital Unwrapping for Conservation and Exploration) seeks to create readable images of texts such as papyrus scrolls, without opening them, using minimally invasive scanning and virtual unwrapping. Seales is developing and evaluating new techniques for digital acquisition, restoration, and visualization using real-world library collections with particular focus on preservation and dissemination. He is also the director of the STITCH project (Surgical Technology Integration with Tools for Cognitive Human Factors), which envisions a networked operating room of the future, where computers and surgical instruments are connected.

Arnold Stromberg, PhD, Bioinformatics/Biostatistics
Stromberg is Professor and Chair, Department of Statistics and Co-Director Statistical Computer Modeling for Bioinformatics Core of the CCTS. Stromberg's expertise is distributed computation and data analysis using supercomputers. As part of INBRE, he provides statistical expertise with DNA microarray data analysis and continues to develop innovative methods of statistical analysis for microarray data. His paper on pooling microarray data is among the ten most downloaded papers in BMC Bioinformatics. He recently served on the university committee that selected the new IBM supercomputer. He directs data analysis for the UK Microarray Core Facility. Stromberg's theoretical and applied background in outlier identification is useful for scanning data for anomalies.

Jeffery Talbert, PhD, Public Health Informatics and EDT
Talbert is Professor in the Department of Pharmacy Practice and Science, Director of the Institute for Pharmaceutical Outcomes and Policy, Co-Director of Biomedical Informatics, and

Associate Director of the Center for Health Services Research. Talbert has over 20 years experience in health research focused on the intersection of policy decisions and health outcomes, including serving as a research fellow for the US Congress, as a faculty member in Public Policy, Public Health, and Pharmacy. Professor Talbert has research interests in pharmaceutical policy, Medicaid policy, and public health informatics. His current research program focuses on two areas: improving health outcomes and efficiency for state Medicaid programs, and policy issues related to reducing prescription drug abuse and diversion.

Stephen Wyatt, MPH, DMD,
Wyatt serves as the Senior Associate Director for the University of Kentucky (UK) CCTS, guiding the Administrative Core and providing oversight (Co-Project Lead) to the critical ATRN Optional Function. His professional background at the CDC and UK has provided significant experience in the development, growth and maturation of complex organizations. A significant area of campus engagement during my his years of service as an academic unit Dean at UK (College of Public Health) was Team Science promotion, including the nurturing/development of multidisciplinary research teams and policies that recognize and reward team science in the tenure/promotion process. He also serves as Vice President for Research at Norton Healthcare in Louisville, KY. This role importantly connects UK, UK Healthcare and the CCTS to the largest healthcare delivery entity in the Commonwealth, providing significant opportunities for research collaboration and access to a diverse urban population.

External Advisory Board (To be confirmed): Philip Payne, PhD, Washington University; Justin Starren, MD, PhD, Northwestern; James Cimino, MD, PhD, UAB; Genevieve Melton-Meaux, MD, PhD, Minnesota

Project Manager: Tamela Harper

Staff: Tony Elam (strategic initiative), Jill Cioci (business administratin), Steven Roggenkamp (research and operations support), Connie Vaughn (administrative assistant)

Membership (initial list)

Below is a partial list of faculty who currently participate in Informatics activities on campus, and who we expect to have an affiliation with IBI, grouped according to expertise:

Molecular and Cellular Processes
Sivakumaran Arumugam, Medicine
David Fardo, Public Health
Mark Farman, Agriculture
James MacLeod, Agriculture
Hunter Moseley, Medicine
Radha Nagarajan, Medicine
Arnold Stromberg, Arts & Sciences
Chi Wang, Markey Cancer Center
Jinze Liu, Engineering

High Performance Computing
Licong Cui, Engineering
Sally Ellingston, Medicine

Eric Grulke, Engineering
James Griffieon, Engineering
Ken Calvert, Engineering
Rama Kavuluru, Medicine

Imaging Informatics
Ken Calvert, Engineering
Nathan Jacobs, Engineering
Brent Seales, Engineering

Clinical and Public Health Informatics
Licong Cui, Engineering
Eric Durbin, Medicine
Jeff Ebersole, Dentistry
Isaac Hands, Medicine
Bin Huang, Public Health
Tom Kelly, Medicine
Sujin Kim, Medicine
Daniel Harris, Pharmacy
Darren Henderson, Pharmacy
Radha Nagarajan, Medicine
Cecilia Page, UK HealthCare
Carol Steltenkamp, UK HealthCare
Jeffery Talbert, Pharmacy
Shiqiang Tao, Medicine
Tom Tucker, Public Health
Heidi Weiss, Public Health
Mark Williams, Medicine
Gregory Zeller, Dentistry

Education
Eric Grulke, Engineering
Jerzy Jaromczyk, Engineering
Tom Kelly, Medicine
Sujin Kim, Medicine
Hunter Moseley, Medicine
Mirek Truszczynski, Engineering

New Faculty Recruits Related to Biomedical Informatics

- The Division of Biomedical Informatics recruited Jin Chen, PhD (starting 8/1/16)
- The Department of Computer Science recruited Licong Cui, PhD (starting 8/1/16)
- Markey Cancer Center, College of Pharmacy, Computer Science, and Biomedical Informatics have ongoing searches intersecting the area of biomedical informatics

IBI Faculty Governance (wrt voting faculty of the educational unit)

When educational policy needs to be established concerning the content of educational activities being homed in the IBI, the educational policy shall be established by the vote of those faculty with recurring, formally assigned instructional, research and/or service duties in

IBI, i.e., the members of the faculty of IBI (GR VII.A.7). When University regulations authorize or require the vote or action of the faculty members of IBI on other matters (e.g., GR IX.III.para 2), then the vote or action concerning the IBI shall be taken by the above faculty membership.

Division of Biomedical Informatics

A research division of Biomedical Informatics has been created within the Department of Internal Medicine in the School of Medicine. Research faculty and other existing faculty members in Biomedical Informatics have been relocated to this new division: Durbin, Ellingston, Nagarajan, Kavuluru, Kim. Efforts for the recruitment of four new faculty recruits are under way, in collaboration among the Department of Computer Science, the Markey Cancer Center, and the Division of Biomedical Informatics, coordinated by IBI. Those recruited in the Department of Computer Science are expected to actively participate in the development of new Biomedical Informatics graduate programs in collaboration with IBI.

In parallel but independent of the IBI, a long-term plan is to grow the Division of Biomedical Informatics into a Department of Biomedical Informatics in the College of Medicine, with about 15 tenure and tenure-track faculty members at steady state and with additional research-track faculty members. The Department will be an essential part of the IBI and serves as its academic home.

Staff, Space, and Facilities Requirements

Achieving the IBI's ambition of an institute with national prominence requires the ability to attract a significant number of scholars in the requisite disciplines. A key incentive for faculty involvement with the institute is the research infrastructure necessary for conducting biomedical informatics research. The IBI will support faculty research by providing expertise through project managers, developers, research assistants, and technical support in data analytics and management throughout the data lifecycle. In addition, the appropriate infrastructure (e.g. administrative support personnel, office space, data management facilities and related personnel, collaborative conferencing facilities, travel funds, and computational resources) is essential to meet the institute goals. In the era of Big Data, a cloud-computing research infrastructure will enable IBI's advances in its research and training missions.

Personnel in Division of Biomedical Informatics (BMI), College of Medicine:

Faculty: the Division of BMI currently has 7 core faculty members (Chen, Durbin, Ellingston, Kavuluru, Kim, Nagarajan, Zhang) and an immediate openning for 2 to 3 core faculty positions. Additional 3 to 4 faculty recruits are planned for the next 4 years.

Staff: the Division of BMI currently has 2 research developers (Tao and TBN being interviewed), 10 research assistants, an administrative staff (Jill Cioci), an administrative assistant (Connie Vaughn), and an executive staff for strategic initiative (Tony Elam).

Office Space:

Short-term: temporal space is provided on the 2nd floor of the Multidisciplinary Science Building within the health science campus. This space consists of 15 offices, 2 conference rooms, and a student lab room, totaling ~2800 sq feet. With a total of 7 faculty, 2 developers,

10 research assistants, 3 administrative staff, *this space will be more than 90% occupied within a year*, after 2-3 new faculty members are recruited.

Long-term: a potential permanent site for IBI would be the Dry Research area inside *Research Building 2*, under construction. The design of the computational research space with a combination of faculty office, shared office, computer and administrative workstation, collaborative presentation space, files storage, lockers, conference room, utility room, and server room would be well-suited for the mission of the IBI.

Servers/Cloud:

A variety of servers and configurations are to be commissioned for supporting web-sites, storage spaces, high-memory and parallel computation. Setup and ongoing cost include installation, maintenance, file systems, power supply, cooling system, switching and support. This environment, plus private cloud would be designed to complement existing infrastructure, and it will serve as a shared computational resource for big data initiatives. An NSF MRI acquisition effort is under way, led by IBI in collaboration with campus IT team.

Equipment and Instrumentation:

The IBI currently has sufficient equipment and resources sourced from the CCTS, UKHC, the Provost, and supporting research grants and contracts. The integration and coordination of resources across campus will provide additional efficiencies for use of major equipment. The leadership will continue to submit grants for near future and long-term future equipment needs and needs may arise on a project-by-project basis. Such development will require new infrastructure, including computing hardware, faculty, and staff appointments and provision for degree-granting programs. The current infrastructure consists of about $2 million of enterprise computing equipment. The center maintains a Dell blade server system (12 nodes with 500 cores), multiple SAN data storage arrays, Dell ML-6020 redundant robotic tape backup systems, and complete VMware virtualization covering database and web servers. Software resources include multiple Oracle and SQL-Server databases, MS Visual Studio development suites; SAS and STATA dedicated server VMs, and Informatica ETL tools.

Projected Operating Costs and Sources of Income

No new funds are requested as a part of this Strategic Plan at this point. Main funds for operational and recurring support fall into the following categories:

- Recurring
    - 5 state faculty lines (recurring)
    - insititutional support ($1.5M) from the CCTS, Provost, College of Medicine, and UK HealthCare
- Non-recurring
    - new faculty startup funds ($1.5M, part of Zhang's startup)
    - new faculty salary support ($2.0M, part of Zhang's startup)
    - staff support ($1.2M, part of Zhang's startup)
    - computational equipment ($250K, part of Zhang's startup)
- Main extramurally funded centers (transferring to UK)

- NINDS: Informatics and Data Analytics Core for Center for SUDEP Research (5U01NS090408, PI Zhang), ~$770K annually, 2015-2019
- NHLBI: National Sleep Research Resource (R24HL114473, MPI Zhang), ~$250K annually, 2015-2018

Sample IBI Initiatives

Center grant and major infrastructure grant application. The IBI has excellent potential for leading and enabling extramural awards. The combined focus of the coordinated investigators affiliated with the IBI will pursue major funding opportunities from the NIH, NSF, FDA, DOD, CDC, foundations, state government, and PCORI.

Proposal inititiatives and partnerships already under way at a variety of stages include CCTS renewal, CTSA X02 multi-hub initiative, NSF MRI, NSF NRT, and NIH P50 RFA for Centers of Excellence on Environmental Health Disparities Research. In addition, the center will work with private corporations and health care companies for collaborative grant opportunities and to discuss major gifts.

Sample interdisciplinary biomedical informatics related grant proposals facilitated by the IBI in the last 6 months are as follows (the number of colleges involved is indicated):

- The UK CCTS renewal to NIH, (6 Colleges, $27 million)
- The Major Research Instrument proposal to NSF, (4 Colleges, $4 million)
- Big Data proposal to NSF, (4 Colleges, $1.5 million)
- National Library of Medicine T15 training grant, (5 Colleges, $2 million)

Data Science Fellowships. To be competitive in the informatics and data science domains and in synergy with the new UK Honors College, there is an opportunity to launch an "institutionally supported" Data Science Fellowship program for both the undergraduate graduate students. For undergraduate students, the fellowship cost could be split 3 ways among Honors College, the primary school within which the student's major resides, and the IBI. For graduate students, the fellowship cost could be split 2 ways between IBI and the academic colleges such as Arts and Sciences, Engineering, Medicine, Pharmacy, Public Health, and Health Sciences within which the graduate program resides. The amount and duration can be determined by available budget and Executive Steering Committee consensus.

IBI Pilot Funding. Most CTSA sites and other types of national centers implement a pilot grant program. An informatics themed pilot program administrated through CCTS pilot award mechanism, would serve as a catalyst for multidisciplinary collaboration. Two informatics themed pilot awards at $30k each per year, with appropriate criteria determined by the Executive Steering Committee, would be an important mechanism for IBI to advance its informatics team science agenda.

IBI Workshops, Seminars and Annual Scientific Retreat. Ad hoc workshops and a regular Annual Scientific Retreat for the IBI would facilitate collaboration, the exchange of ideas, and promote a sense of community. An active journal club coordinated by Hunter Moseley is titled System Biology Omics Integration (SBOI).

APPENDIX A. ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AMIA	American Medical Informatics Association
ATRN	Appalachian Translational Research Network
BMI	Biomedical Informatics
CCTS	Center for Clinical and Translational Science
CTSA	Clinical and Translational Science Award
CTR	Clinical and Translational Research
EDT	Enterprise Data Trust
EAB	External Advisory Board
IBI	The Institute for Biomedical Informatics
KY	Kentucky
KCR	Kentucky Cancer Registry
SBOI	System Biology Omics Integration
UKHC	UK HealthCare
VPR	Vice President for Research

List of support letters for the creation of the Institute for Biomedical Informatics

- Michael J. Becich, MD PhD, Distinguished University Professor and Chairman, Department of Biomedical Informatics, University of Pittsburgh
- John Y. Walz, PhD, Dean of College of Engineering, UK
- Donna Arnett, PhD, Dean of College of Public Health, UK
- Kelly Smith, PharmD, Interim Dean, College of Pharmacy, UK
- Philip A. Kern, MD, Director, Center for Clinical and Translational Science
- Mark Kornbluh, PhD, Dean Arts and Sciences
- Jeff Ebersole, DMD PhD, Associate Ddean for Research, College of Dentistry
- Fred deBeer, Dean, College of Medicine
- Mark Williams, MD, Director of the Center for Health Services Research
- Jim Griffioen, PhD, Director Center for Computational Sciences
- James Macleod, VMD PhD, Veterinary Medicine
- Michael Kilgore, PhD, College of Medicine faculty council
- Arny Stromberg, PhD, Department Chair Statistics
- Mark Farman, PhD, College of Agriculture

UNIVERSITY OF KENTUCKY
College of Agriculture, Food and Environment

MEMORANDUM

TO: UK Senate's Academic Organization and Structure Committee (SAOSC)

FROM: Dr. Lynne Rieske-Kinney, Chair LRK
CAFE Faculty Council (FC)

DATE: April 25, 2016

RE: CAFE Faculty Council Vote on
Institute for Biomedical Informatics

The College of Agriculture, Food and Environment Faculty Council has reviewed the proposal for establishing the new Institute for Biomedical Informatics.

The 10-member College of Agriculture, Food and Environment Faculty Council voted as follows:

Yes, support the creation of this center	7
No, do not support the creation of this center	0

Three members of the FC has abstained, due to not being available at this time.

Thank you.

University of Pittsburgh

Department of Biomedical Informatics

The Offices at Baum
5607 Baum Blvd.
Pittsburgh, PA 15206-3701
412-624-5100
Fax: 412-62-5310
www.dbmi.pitt.edu

January 24, 2016

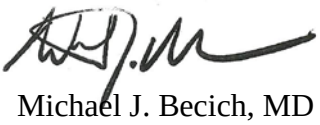
Dear Dean De Beer:

During my tenure as a member of the UK Center for Clinical and Translational Science (CCTS), External Advisory Board (EAB), the need and opportunity to grow biomedical informatics capacity, research, service and education was a major focal point for both the EAB and the CCTS leadership. One of the major EAB recommendations in 2014 was the need to better organize and position biomedical informatics (BMI) efforts on the UK campus, by creating a Division of BMI in the College of Medicine and forming a campus wide entity to catalyze collaboration across your campus.

In winter 2015 I visited your campus as a consultant on this issue providing additional guidance. I am pleased that the discussions/recommendation has resulted in a proposal to create the Institute for Biomedical Informatics (IBI). The proposal articulates that the IBI has been designed to bridge campus faculty from various academic units together to meet a clear need. In addition, proposing the Institute have a reporting line to the Provost and seeking the highest levels of campus approval (Senate and Board of Trustees), strategically positions the Institute for the future.

Biomedical informatics has been a strategic and growing area across the country for over a decade. This growth is intensifying, driven by many factors that include national initiatives such as Big Data, Precision Medicine, and Leaning Healthcare Systems. As the commonwealth's flagship institution and leader in the state of Kentucky for academic medicine and healthcare, the establishment of the Institute of Biomedical Informatics is strategically important and timely for the University of Kentucky.

Sincerely,



Michael J. Becich, MD PhD
Distinguished University Professor and Chairman, Department of Biomedical Informatics (http://www.dbmi.pitt.edu), University of Pittsburgh School of Medicine
Associate Chancellor for Informatics for the Health Sciences
Professor of Pathology, Information Sciences/Telecommunications and Clinical/Translational Science
Director, Center for Commercial Application (http://www.healthdataalliance.com) of Healthcare Data for the Pittsburgh Healthcare Data Alliance
Associate Director, University of Pittsburgh Cancer Institute (http://www.upci.upmc.edu)
Associate Director, Clinical and Translational Science Institute (http://www.ctsi.pitt.edu)

UNIVERSITY OF KENTUCKY

Office of the Dean
College of Engineering
351 Ralph G. Anderson Building
Lexington, KY 40506-0503
859 257-1687
Fax 859 257-5727
www.engr.uky.edu

January 25, 2016

Dr. Fred DeBeer
Dean, College of Medicine
900 S. Limestone Street
Lexington, KY 40536-0200

Dear Dean DeBeer:

College of Engineering faculty and staff have been engaged in discussions about the need for a campus-wide entity to catalyze biomedical informatics research and service for almost two years.

I am pleased that these efforts have resulted in a proposal to create the Institute for Biomedical Informatics (IBI). The proposal articulates that the IBI has been designed to bridge campus faculty from various academic units together to meet a clear need. In particular, our Department of Computer Science, through department chair Brent Seales' leadership, has already been engaged in the planning of the IBI and will serve on its Executive Steering Committee.

I am also pleased that the proposed leadership decided to seek a reporting line to the Provost and the highest levels of campus approval (Senate and Board of Trustees). On behalf of the College of Engineering faculty, I am pleased to offer our support for the creation of IBI as a campus-wide Center/Institute.

On behalf of the College of Engineering, I fully support the establishment of the IBI.

Sincerely,

John Y. Walz

John Y. Walz
Dean

UNIVERSITY
OF KENTUCKY

College of Public Health

Department of Epidemiology
111 Washington Ave., Suite 213
Lexington KY 40536-0003
(859) 218-2330 phone
(859) 257-8811 fax
http://www.uky.edu/PublicHealth

January 25, 2016

Frederick C. deBeer, M.D.
Dean, College of Medicine
University of Kentucky
900 S. Limestone Street
Lexington, KY 40536-0200

Dear Dean deBeer:

Through the efforts of my predecessor in the College of Public Health (CPH), Dr. Steven Wyatt, in cooperation with the Center for Clinical and Translational Sciences, a Division of Biomedical Informatics was created in CPH in 2010 and served as the initial academic home for biomedical informatics faculty on the UK campus. The CPH faculty recently supported the move of those faculty members to the College of Medicine. This coincided with the advice of several consultants and the BMI/CCTS external advisory committee recommendations regarding the most strategic academic appointment location for these faculty members.

Health and healthcare data are simply critical to population/public health and the proposed creation of the Institute of Biomedical Informatics (IBI) will help address a campus need to engage faculty from multiple academic units in research, service and education efforts. The IBI is intended to be the cohesive entity that will bring together informatics expertise on campus. The proposed reporting line to the Provost and seeking the highest levels of campus approval (Senate and Board of Trustees) positions the IBI to help meet that need. Therefore, on behalf of the College of Public Health faculty, I am pleased to offer our support for the creation of IBI as a campus-wide Institute.

Sincerely,

Donna K. Arnett, PhD
Professor and Dean

Office of the Dean
College of Pharmacy
789 S. Limestone St.
Lexington, KY 40536
859 257-7896
kelly.smith@uky.edu

Jan. 26, 2016

Dr. Fred DeBeer
Dean, College of Medicine
900 S. Limestone Street
Lexington, KY 40536-0200

Dear Dean DeBeer,

Thank you for sharing the specifics regarding the proposed creation of the Institute for Biomedical Informatics (IBI). The College of Pharmacy has had an active health data/healthcare informatics research program for several years as guided by Dr. Jeff Talbert and engaging many of our faculty. I am pleased that Dr. Talbert has been part of the planning of IBI and is proposed as a senior leader in IBI. The need for a campus-wide entity to coordinate and catalyze bioinformatics/biomedical informatics research and service is very clear; thus, the IBI has been designed as that entity. The proposed reporting line to the Provost and seeking the highest levels of campus approval (Senate and Board of Trustees) positions the IBI to help meet that need. Therefore, on behalf of the College of Pharmacy faculty, I am pleased to offer this letter of support for the creation of IBI as a campus-wide Center/Institute.

Sincerely,

Kelly M. Smith, PharmD
Interim Dean

UNIVERSITY OF KENTUCKY

CCTS

CENTER FOR CLINICAL AND TRANSLATIONAL SCIENCE

ACCELERATING DISCOVERIES TOWARD BETTER HEALTH

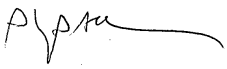
February 24, 2015

Tim Tracy, Ph.D.
Office of the Provost
105 Main Building
University of Kentucky
Lexington, KY 40506-0032
University of Kentucky

Dear Dr. Tracy:

The Center for Clinical and Translational Science is developing a new interdisciplinary research center focused on biomedical informatics. We developed the enclosed white paper following the requirements outlined in the University Administrative Regulation 1:3, and are notifying the Office of the Provost of our intent to establish the new center. We plan to establish the Center for Biomedical Informatics (CBMI) as a small 'c' informal center immediately, while we continue to develop the formal proposal required to establish the Center under AR 1:3. As the attached proposal describes, biomedical informatics research spans several Colleges across the University and would greatly benefit by creating a new interdisciplinary home to catalyze biomedical research at the University of Kentucky. This new center will also provide a solid informatics foundation for the CCTS and help attract a top level researcher to serve as the center Director. We look forward to working with you on the new center.

Sincerely,



Philip A. Kern, M.D.
Director, CCTS
Associate Provost for Clinical and Translational Sciences

CitE! Cite grant number UL1TR000117 for the NIH CTSA at the University of Kentucky

UNIVERSITY OF
KENTUCKY
College of Arts and Sciences
Office of the Dean
202 Patterson Office Tower
Lexington, KY 40506-0027
859 257-8354
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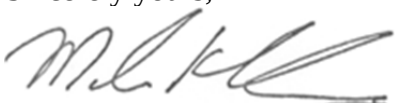
April 12, 2016

Dear Anthony Elam,

The Dean, Executive Committee and relevant department chairs in the College of Arts and Sciences support establishing the Institute of Biomedical Informatics (IBI).

The college views the IBI to be a valuable collaboration between researchers in almost all of the colleges at UK and many departments within those colleges. In Arts and Sciences, the Departments of Statistics, Mathematics, Physics, Biology, Chemistry and others will benefit directly from the IBI being established. The IBI will allow access to NIH and other funding opportunities for many researchers that would not be available without collaborating with the IBI.

Sincerely yours,



Mark Lawrence Kornbluh
Dean

UNIVERSITY OF KENTUCKY
College of Dentistry

Center for Oral Health Research
414 Health Sciences Research Bldg.
Lexington, KY 40536-0305
859 323-8229
fax 859 257-6566
www.mc.uky.edu/COHR

April 18, 2016

TO: Dr. Fred Debeer
Dean, UK College of Medicine

FROM: Dr. Jeffrey L. Ebersole
Associate Dean for Research
University Research Professor
College of Dentistry

SUBJECT: Support for Institute for Biomedical Informatics

I want to thank the group for sharing the specifics regarding the proposed creation of the Institute for Biomedical Informatics (IBI). As a faculty member of the College of Dentistry, and Associate Dean for Research I fully support the establishment of the Institute of Biomedical Informatics. The creation of the Institute will provide a valuable platform to bring together campus faculty from various academic units to collaborate on a variety of informatics initiatives. Researchers in the College of Dentistry would benefit greatly by the availability of this organized support core at UK, and personally, my own research has benefited by the expanded support in this area over the last few years. I look forward to working with the IBI and Dr. Zhang to establish a central home for biomedical informatics work at UK and provide a clear "go to" site for the range of basic and translational research sciences in oral health that are carried out in the College.

Based upon my last 16 years at UK, transitioning through various administrative structures for overall and research specific leadership, I believe that the proposed reporting line to the Provost combined with the review and consent from the highest levels of campus governance (Senate and Board of Trustees), positions the IBI to help catalyze the interdisciplinary UK vision for biomedical informatics. Therefore, I am pleased to offer this letter of support for the creation of IBI as a campuswide Center/Institute.

Please do not hesitate to contact me if you have any questions.

150 YEARS 1865 - 2015

UNIVERSITY OF KENTUCKY

College of Medicine
Office of the Dean
Vice President for Clinical Academic Affairs
CTW301, 900 South Limestone
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859 323-5079
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www.uky.edu

MEMORANDUM

TO: Lisa Cassis, PhD, Vice President for Research
and
Timothy Tracy, PhD, Provost

FROM: Frederick C. de Beer, MD, Dean, College of Medicine
and
David J. Moliterno, MD, Chair, Department of Internal Medicine

DATE: November 6, 2015

SUBJECT: Institute for Biomedical Informatics

Provost Tracy and VPR Cassis, attached please find for your review a proposal to formally create the Institute for Biomedical Informatics (IBI). Once this proposal has been approved by the two of you, it is our understanding it would require Senate review/approval prior to moving to the Board of Trustees.

The IBI will initially be "housed" within the Department of Internal Medicine, College of Medicine. However, the vision is for IBI to fulfill a campus-wide need for enhancing and coordinating biomedical informatics capacity across the entire campus. The IBI will serve as a key strategic asset for UK, creating research, service and education connections with multiple campus units and research centers especially; UK HealthCare, the health colleges, College of Arts and Sciences, College of Engineering, Markey Cancer Center, Center for Health Services Research, Sanders Brown Center on Aging and the Center for Clinical and Translational Science. In addition, the proposed organizational structure includes both internal and external advisory groups to ensure IBI is strategically-positioned both on campus and nationally.

cc:
Michael Karpf, EVPHA

UNIVERSITY OF KENTUCKY
Center for Health Services Research

Applying Research to Optimize Care©

Mark V. Williams, MD, FACP, MHM
Professor & Vice Chair
Department of Internal Medicine
Director, Center for Health Services Research

April 14, 2016

Robert S. DiPaola, MD
Dean, College of Medicine
University of Kentucky

Dear Dean DiPaola:

I strongly support the proposed creation of the Institute for Biomedical Informatics (IBI). As Director of the UK Center for Health Services Research, I am already collaborating with GQ Zhang, PhD on projects to improve care at UK HealthCare and develop research projects. The establishment of the Institute of Biomedical Informatics will provide a valuable platform to bring together campus faculty from various academic units (e.g., engineering, business, pharmacy, public health, medicine, health sciences, nursing, etc.) together to collaborate on a variety of informatics initiatives.

The IBI will facilitate opportunities for the Center for Health Services Research. I look forward to working with the IBI and Dr. Zhang.

I also agree that the proposed reporting line to the Provost and seeking the highest levels of campus approval (Senate and Board of Trustees), positions the IBI to help catalyze the interdisciplinary UK vision for biomedical informatics. Therefore, on behalf of the Center for Health Services Research, I am pleased to offer this letter of support for the creation of IBI as a campuswide Center/Institute.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Mark Williams

Mark V. Williams, MD, FACP, MHM
Professor & Vice-Chair, Department of Medicine
Director, Center for Health Services Research
Chief Transformation & Learning Officer, UK HealthCare

UNIVERSITY OF KENTUCKY

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April 18, 2016

Dr. GQ Zhang
Director of the Institute of Biomedical Informatics
University of Kentucky
725 Rose Street
Lexington, KY 40506

Dear Dr. Zhang,

I am writing to enthusiastically offer my support for your Institute for Biomedical Informatics (IBI). Biomedical Informatics is a growing and critical area of data science, big data analytics and computational science.

The mission of the UK Center for Computational Sciences (CCS) is to provide computational support, expertise, and education to researchers across campus including computational challenges that occur at the interface of the life, physical, and statistical sciences. Interdisciplinary understanding is key to computational research that crosses multiple science domains. CCS is a logical collaborator with IBI, and I look forward to pursuing joint research opportunities. Together we can effectively bridge biomedical, statistical, mathematical, and computational disciplines while utilizing and translating biomedical big data with our latest high performance computing resources.

As the Director for CCS, I strongly support the proposed Institute for Biomedical Informatics.

Sincerely,

James Griffioen
Director, Center for Computational Science

Center for Computational Sciences
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UNIVERSITY OF KENTUCKY

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Professor of Veterinary Science
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April 15, 2016

GQ Zhang, Ph.D.
Chief, Division of Biomedical Informatics
Department of Internal Medicine
University of Kentucky

Dear Dr. Zhang:

I am writing to indicate my very strong support for establishing the Institute of Biomedical Informatics (IBI). My laboratory utilizes computational strategies to analyze the transcriptome and investigate genome to phenome relationships. Our emphasis has been the musculoskeletal system of horses, with a focus on the growth and maturation of articular cartilage, development and progression of osteoarthritis, and the repair of articular lesions. Over the past 7 years, I have collaborated with Dr. Jinze Liu in the Department of Computer Science. Productivity from our efforts have included co-authorship on the equine genome sequencing paper published in Science (PMID 19892987) and a total of eight other manuscripts. One of these papers, published in Nucleic Acids Research (PMID 20802226), has now been cited 343 times. In addition, we have been successful securing extramural funding, including grants from the National Science Foundation (EF-0850237) and National Institutes of Health (RO1 HG006272). Our collaboration continues, generating new and very large transcrtiptome datasets, the analyses of which will be greatly enhanced by the university's investment in biomedical informatics.

I am also excited to work with the Institute of Biomedical Informatics in connection with the new Equine Sports Science Initiative in the College of Agriculture, Food and Environment. I am the director of this program. We are developing medical informatic databases of injuries in equine athletes to empower scientific discovery related to several of the major catastrophic injuries suffered by racehorses. Horses and the equine industry hold a strong historical, social, and economic position in Kentucky, indeed representing a defining symbol of our state that is recognized and appreciated on both a national and international level. Improving the medical ontologies of equine athlete injuries and expanding both the amount of data available and our ability (through informatics) to analyze these data will greatly enhance our biomedical research efforts.

Thank you very much for the opportunity to both support and participate in the IBI.

Sincerely,

James N. MacLeod, VMD, PhD
John and Elizabeth Knight Chair
Professor of Veterinary Science
Director, Equine Sports Science Initiative

UNIVERSITY OF KENTUCKY

Michael Kilgore, Ph.D.
Associate Professor
Department of Molecular and
Biomedical Pharmacology
College of Medicine
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Dr. GQ Zhang
Co-Director, Bioinformatics Core
Department of Internal Medicine,

April 13, 2016

Dear Dr. Zhang,

The Faculty Council has reviewed the proposal to establish an Institute for Bioinformatics and offer our full support. The IBI will help bring together expertise and resources from across campus that will help to address critical needs for the College of Medicine and the University as a whole. We look forward to working with you on this important program.

Sincerely,

Michael Kilgore, PhD
College of Medicine Faculty Council, Chair
Molecular and Biomedical Pharmacology
University of Kentucky College of Medicine

UNIVERSITY OF KENTUCKY

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859 257-6115
fax 859 323-1973
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April 15, 2016

To Whom It May Concern,

As a member of the Executive Steering Committee of the proposed Institute for Biomedical Informatics (IBI) and on behalf of the Department of Statistics, I fully support its being established.

The IBI will coordinate collaborative bioinformatics grant proposals bringing together researchers from all over campus. Currently UK researchers from the Colleges of Arts and Sciences, Medicine, Pharmacy, and Engineering will soon submit a NIH T15 (Big Data) training grant that would be strengthened if the IBI is established. The grant would support post doctoral training in bioinformatics that would benefit many researchers

Sincerely,

Dr. Arnold J. Stromberg
Professor and Chair
Department of Statistics
University of Kentucky

College of Agriculture,
Food and Environment
Department of Plant Pathology
201F Plant Science Bldg
Lexington, KY 40546-0312
Phone: (859) 218-0728
Fax: (859) 323-1961
http://www.ca.uky.edu/agcollege/plantpathology/index.html

Aril 15th, 2016

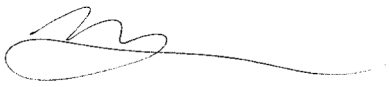
Dear Dr. Bailey,

As a faculty member of the College of Agriculture, and Associate Director for UK-Healthcare Genomics, I am in strong support of the establishment of the University of Kentucky Institute of Biomedical Informatics. The creation of this Institute will provide a valuable platform to bring together campus faculty from various academic units to collaborate on a variety of informatics initiatives.

As an example, the recent recruitment of Dr. Jin Chen, a talented faculty member from the DOE-Plant Research Laboratory at Michigan State University, was possible because he was impressed by the idea of being a part of an institutional entity geared toward developing campus-wide collaborations. The proposed Institutional resources would greatly facilitate his ability to collaborate with faculty from the College of Agriculture and College of Medicine.

Please do not hesitate to contact me if you have any questions.

Sincerely,



Mark L. Farman

Professor, Department of Plant Pathology

Associate Director, UK Healthcare Genomics

UNIVERSITY OF KENTUCKY

April 25, 2016

Ernest Bailey, PhD
Professor
Chair of SAOSC

Re: Addendium to the proposal for the Institute for Biomedical Informatics

Dear Dr. Bailey,

Thank you and the Senate Academic Organization and Structure Committe (SAOSC) for your review and feedback on the proposal to establish the Institute for Biomedical Informatics.

We would like to submit the appended addendum (next page) for consideration by SAOSC, together with the other materials that have already been submitted. The plan is, after SAOSC's approval, to incorporate the items listed in the addendium for an updated proposal for review and approval by the Senate Council.

We look forward to working with SAOSC to address any additional questions or concerns.

Sincerely,

GQ Zhang, PhD
Chief, Division of Biomedical Informatics
College of Medicine

Addendium to the Proposal for the Institute for Biomedical Informatics
April 25, 2016

The purpose of the Institute is to catalyze interdisciplinary research and training on bio- and medical informatics across the UK campus. The initial proposal was developed almost a year ago. The purpose of this addenedium is to summarize a list of updates to be reflected in the next version for Faculty Senate Council, based on feedbacks and additional acitivities and changes that have taken place since then:

- **New Faculty Recruits Related to Biomedical Informatics**
  - The Division of Biomedical Informatics recruited Jin Chen, PhD (starting 8/1/16)
  - The Department of Computer Science recruited Licong Cui, PhD (starting 8/1/16)
  - Markey Cancer Center, College of Pharmacy, Computer Science, and Biomedical Informatics have ongoing searches intersecting the area of biomedical informatics

- **Interdisciplinary Biomedical Informatics Related Grant Proposals Submitted (in the last 6 months; the number of colleges involved are also indicated)**
  - The UK CCTS renewal to NIH, (6 Colleges, $27 million)
  - The Major Research Instrument proposal to NSF, (4 Colleges, $4 million)
  - Big Data proposal to NSF, (4 Colleges, $1.5 million)
  - National Library of Medicine T15 training grant, (5 Colleges, $2 million)

- **Additional Colleges, Centers, and Investigators Participating in the Institute Proposal (some of these faculty may serve in the Institute's executive steering committee)**
  - College of Agriculture
    - Mark Farman, PhD
    - Jamie MacLeod, PhD
  - College of Dentistry
    - Jeff Ebersole, PhD
    - Gregory Zeller, PhD
  - James Griffioen, the new Director for the Center for Computational Sciences, is expected to play the role that Vince Kellen played wrt the Institute

- **Ongoing Interdisciplinary Biomedical Informatics Related Seminars and Workshops**
  - System Biology Omics Integration (SBOI, coordinated by *Hunter Moseley*, PhD)
  - Biomedical Informatics Research Seminar

- **Updated External Advisory Board**
  - Philip Payne, PhD, Washington University
  - Justin Starren, MD, PhD, Northwestern
  - James Cimeno, MD, PhD, UAB
  - Genevieve Melton-Meaux, MD, PhD, Minnesota