

RESEARCH STRATEGIC PLAN

BACKGROUND

In mid-December 2013, Dean Berman announced his intention to work with the faculty to develop a strategic vision to guide the school's research emphases over the next decade. The purpose was to articulate our strengths, needs and priorities prior to the anticipated launch of a new university-wide fundraising campaign. Because discussions were already occurring within departments partially as a result of basic science department reorganization, the first stage was to ask departments to complete these planning efforts. A faculty committee would subsequently review departmental plans, with the charge of finding commonalities, identifying strengths and gaps, and developing cross-cutting themes. The next stage was to elicit faculty feedback, a process that would commence in June and result in the development of a final plan by the fall.

Consequently, we were well positioned on the research front to comply with the University's request to transmit a strategic plan for the school by mid-June 2014, although the University's timeline required a more abbreviated timeframe. As with the other strategic planning committees, our report represents the beginning of the process. We hope that our deliberations will provide the framework and guidance needed to work together on a more detailed plan.

The five research-based departments – Developmental Molecular and Chemical Biology, Integrative Physiology and Pathobiology, Molecular Biology and Microbiology, Neuroscience and Public Health and Community Medicine – were asked to engage their faculty in discussions during January and February that would lead to departmental reports. These reports provided essential information on each faculty member's research emphasis and potential collaborations, as well as a department-wide assessment of research strengths, vulnerabilities, and areas of future exploration. This information, and the research vision statements that were offered, have been an essential core of the committee's work.

During the course of six meetings, the committee reviewed the departmental reports and in a robust exchanges of ideas, developed a framework for the future. The following paragraphs provide thumbnail sketches of each department's strengths, needs and research directions and priorities. The diagrams that follow the text attempt to capture this information in graphic format.

Molecular Biology and Microbiology

Faculty research focuses on fundamental studies of basic biology of microbes – viruses, bacteria and fungi – with a particular strength in bacterial studies. MBM is known for its emphasis on microbiology relating to pathogens and microbial resistance. Faculty members have been successful in generating new techniques and innovative technologies including a variety of novel genetic approaches and, more recently, advanced microscopic approaches to further departmental research efforts. Four major research priorities are outlined for the future. Continued emphasis will be placed on food and waterborne diseases, nosocomial infections and anti-microbial resistance, areas that are current

strengths. TB and TB/HIV and the microbiome are in a more nascent stage but the department would like to build in these areas.

Neuroscience

The department's vision is to become world-renowned in translational neuroscience by establishing teams of investigators that focus on four neurological disorders: epilepsy, obesity, autism and neurodegeneration. Current research strength centers on synaptic and glial biology, particularly in the areas of GABA-mediated synaptic transmission, astrocyte-neuron synaptic interaction, and synapse formation. These areas relate well to the neurological disorders mentioned above as well as to neurodevelopmental disorders and other neurological diseases. Collaborations with local biotechnology and pharmaceutical companies have provided opportunities to develop next stage treatments for neurologic disorders. Areas of interest that could be developed include neuro-inflammation, approaches involving iPS cells and better approaches to analyzing large data sets.

Public Health and Community Medicine

This multi-disciplinary department has a broad reach in terms of research strengths. However, as with other departments, adequate depth does not exist in several of these areas. Faculty research is driven by community issues and focuses on specific disease-based patient populations, with pertinence to global communities. The department strives to have all faculty engaged in interdisciplinary work that improves human health. Specific areas of strength include: the relationship of the environment to health outcomes; infectious disease and nutrition; obesity and chronic disease; global health; environmental health and health policy. The department depends on community engagement, health communications, qualitative methods and epidemiology and biostatistics to achieve its research goals. Areas for growth that synergize with research themes include spatial and computational epidemiology and health informatics.

Developmental Molecular and Chemical Biology

DMCB is a newly created department that includes faculty from the previous departments of Anatomy and Cell Biology, Biochemistry, Pathology and Molecular Physiology & Pharmacology. Faculty are united by an overarching interest in understanding cell function from the chemical to organismal level as it relates to cancer and other diseases of development. The department strives to integrate traditional studies of developmental biology and biochemistry with structural and chemical biology to facilitate the discovery of novel therapeutics targeting the molecular mechanisms underlying human disease, especially cancer. There is a strong base in cancer, particularly infectious cancers as well as breast and brain cancer. Building DMCB relies on strategic hiring and investment in specific thematic areas encompassing stem cells and the microenvironment, signaling and therapeutic development. A relationship to developmental diseases and cancer is an important part of this strategy.

Integrative Physiology and Pathobiology

IPP is another new department that reflects the conjoining of faculty from the previous departments of Anatomy and Cell Biology, Pathology and Molecular Physiology & Pharmacology. While scientists

represent many different disciplines, some overarching themes are emerging. Among these are inflammatory diseases, autoimmune diseases and some other chronic diseases. Because the theme of inflammation underlies an important component of the research vision for all departments, the new chair is expected to be a leader in this field who will become an important driver in this effort. Recruitment is proceeding, with first-round interviews coming to a close this July. Several junior and senior recruitments will begin thereafter.

COMMON NEEDS

As a medical school with a relatively small research enterprise, our strategic plan should capitalize on current strengths so that we can become leaders in selected areas. In addition to having department specific goals as described in the preceding section, common concerns and needs must be addressed if we are to build the research enterprise envisioned. These are:

- **High quality research space.** The availability of modern, high quality research space is limited. The Jaharis building, completed just over 10 years ago, was not designed with the ratio of lab to support space that is currently considered optimal for research space. In addition, office space is lacking on some floors. Without additional investment, labs cannot be used at the maximum level of efficiency. The majority of unoccupied or under-utilized research space is in the BRPH complex, which lacks appropriate infrastructure to provide adequate air exchange and necessary support for research efforts. The two wings (South Cove & Arnold) that were renovated in the past decade are nearly fully occupied but suffer from the same compromised infrastructure. Some departments are “landlocked” without the ability to expand as research dollars grow. The M&V and Stearns wings are almost entirely unrenovated, with small interconnected rooms that are not suitable for modern research. Adequate space has not yet been identified for the all faculty recruitments in IPP and DMCB.
- **Core Facilities.** Core facilities are limited, requiring dependence on expensive off-site facilities. Some existing cores are well-utilized and have modern equipment and well-trained staff. In other cases, key services are not available. For all cores, support to faculty who depend on these services must be improved.
- **Faculty Census.** Additional faculty members, particular at the junior level, are essential to strengthen key research priorities. We lack depth even in areas of strength, expertise in some key fields, and the number of junior faculty recruitments has been constrained due to financial issues.
- **Instrumentation.** Upgrades for existing instruments and the addition of new equipment are needed if faculty members are going to be competitive in their research. An example is our goal to enhance research in pulmonary disease, which requires acquisition of several pieces of costly equipment.

- **Support for annual reinvestment in the research enterprise.** Such support would insure that equipment is maintained and also provide funds for pilot and exploratory projects.

Department-specific needs are summarized in the diagrams appended.

RECOMMENDATIONS

The committee was unanimous in recommending the importance of raising funds for departmental priorities while also identifying school-wide themes and goals.

The committee deliberated on a construct that would frame research priorities to encompass school-wide themes. The paragraphs below describe this framework. Additionally, several departments offered overarching concepts that were developed to describe their research. With some jiggering, these concepts might provide a good way to describe the school's research vision. These "mega-themes" include: *Improving the Quality of Life; Discovery, Innovation and Application; Understanding the Microbe: Human Interface; and Working Across Disciplines and Global Boundaries.*

1. **What: Inflammation** is a unifying biological mechanism that could be a hub for multi-disciplinary research in all five departments. Research in inflammation can be conceived as a biomedical question centered on mechanisms that bring researchers working on a range of diseases that involve inflammatory processes. Such diseases include most chronic diseases of health importance, and a planned research focus to be developed within IPP involves inflammation and chronic disease, providing a potential avenue to further strengthen the TUSM program in this area. Some thought must be devoted to conceptualizing inflammation in a way that is understandable to the broader community and attractive to donors.
2. **Who: Touching individuals across the arc of life** is an idea that is consistent with the inflammation concept and expands upon it. This idea also has the potential to encompass personalized medicine, which is a much broader concept that would need to be expanded through future efforts.
3. **Where: One population of interest is the community in which we reside.** Embedded in the third largest Chinatown in the US, TUSM has an opportunity to improve the quality of life for individuals in this community. The migratory patterns that bring populations to Chinatown, community-based studies and using health communication research are all areas in which TUSM can make an impact. Asian health incorporates diseases such as TB, some types of cancer, and the effect of the environment on a variety of chronic disease states. This area is ripe for collaboration between TUSM, TUSDM, the HNRCA and Tufts Medical Center.
4. **How: Bioinformatics to manipulate big data** so that cutting edge methodologies can be employed to underpin research efforts. Big data, computation and systems analysis are needs

shared by all departments. Areas of interest include a variety of state-of-the-art technologies, some of which are more important for certain faculty groups than others. For example, analysis of big data sets is an important component for working on the microbiome while for PHCM, valuable social demographic and clinical data could be mined from Medicare with the appropriate faculty expertise. Faculty recruitment is sometimes compromised because we lack these resources.

The group felt that TUSM should have a bioinformatics core program and that faculty must be recruited who have original research that relies on big data. This idea stems from the fact that faculty actively engaged in research drive technology forward in ways that cannot always be accomplished by individuals who staff a core. The core should encompass both dry and wet lab research. PHCM could serve as the home for both the core and faculty, although some faculty might be appointed in the departments.

Other cores that need to be developed or resourced to study diseases and disease processes are on-site animal models, metabolomics, imaging, tissue engineering, and development of iPS cells. The group was extremely sensitive to the idea that certain resources needed to be on-site but that resources available elsewhere related to materials that could be "shipped" outside should not necessarily be duplicated on-site.

Committee Members:

Harris Berman and Naomi Rosenberg, co-chairs

Olaf Dammann, PHCM

Phil Haydon, Neuroscience

Phil Hinds, DMCB

Carol Kumamoto, MBM

John Leong, MBM

Laura Liscum, IPP

Jamie Maguire, Neuroscience

Aviva Must, PHCM

Brian Schaffhausen, DMCB

Christine Wanke, PHCM

Henry Wortis, IPP

Staff: Marsha Semuels

Appendix 1

Departmental Diagrams: Priorities, Research Areas and Approaches

Developmental, Molecular and Chemical Biology

Discovery, Innovation, Application

Stem cells & the
microenvironment

Target Identification

Cancer

Drug Design

Patient-derived iPS cells

Structural Biology

Computational Biology

Animal Models and Tissue Equivalents

Infectious Cancers

 needs development

 existing strength

 approach / technique

 research area

Developmental, Molecular and Chemical Biology

Discovery, Innovation, Application

Stem cells & the
microenvironment

Target Identification

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 research area

Integrative Physiology and Pathobiology

Metabolic Syndrome
Diabetes/CVD/Obesity

Host Response to
Infection

Tumor Biology
Fibroblasts/GI/Nasopharyngeal

Joint / Autoimmunity
Osteoarthritis/RA/Lupus

Cornea / Eye

Arc of life
Community/Asian health
Inflammation

Systems analysis of big data

Regeneration / Repair

Women's Health

Microbiome

needs development
existing strength

approach / technique
research area

Molecular Biology and Microbiology

Understanding the Microbe-Human Interface

TB and TB/HIV

Nosocomial Infection

Food & Waterborne Disease

Disease of Microbiome Dysfunction

Arc of life
Community/Asian health
Inflammation

Tissue Engineering

Metabolomics / Mass Spec

Systems Analysis of Big Data

Germ-free mice

Microbial physiology and metabolism

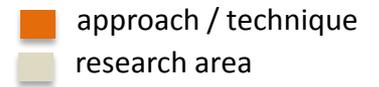
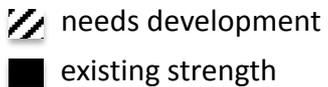
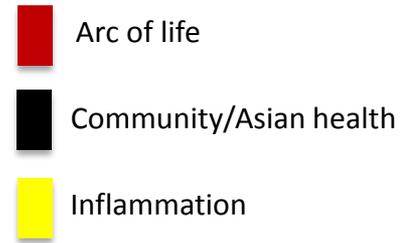
Host-microbe interactions

needs development
existing strength

approach / technique
research area

Neuroscience

Improving the Quality of Life



Public Health and Community Medicine

Working Across Disciplines and Global Boundaries

Infectious Diseases

Health Policy

Obesity & Chronic Disease

Global Health

- Arc of life
- Community/Asian health
- Inflammation

Community-Engaged Research

Health Communication

Qualitative Methods

Epidemiology & Biostatistics

Spatial & Computational Epidemiology, Health Informatics

Technology & Health

Nutrition & Infection

Human Development

Environmental Health

- needs development
- existing strength

- approach / technique
- research area