Boston University Committee on the Basic Life Sciences

Final Report, 7 June 2017

Co-chairs: Douglas Rosene, Professor of Anatomy & Neurobiology, BUSM Michael Sorenson, Professor of Biology & Associate Dean of the Faculty, CAS Committee members: Karen Allen, Professor of Chemistry, CAS Christopher Chen, Professor of Biomedical Engineering, ENG Ronald Corley, Professor of Microbiology & Director, National Emerging Infectious Diseases Laboratories Catherine Costello, William Fairfield Warren Distinguished Professor of Biochemistry & Director, Center for Biomedical Mass Spectrometry, BUSM David Harris, Professor & Chair of Biochemistry, BUSM Michael Hasselmo, Professor of Psychological & Brain Sciences, CAS & Director of the Center for Systems Neuroscience Linda Hyman, Professor of Microbiology & Associate Provost, Division of Graduate Medical Sciences Catherine Klapperich, Professor of Biomedical Engineering & Assoc. Dean for Research, ENG & Director, Center for Future Technologies in Cancer Care Darrell Kotton, David Seldin Professor of Medicine & Director, Center for Regenerative Medicine William Lehman, Professor of Physiology and Biophysics, BUSM Kim McCall, Professor & Chair of Biology, CAS Daniel Segrè, Professor of Biology & Physics, CAS & Professor of Bioinformatics & Biomedical Engineering Thomas Tullius, Professor of Chemistry, CAS & Director, BU Bioinformatics Program Benjamin Wolozin, Professor of Pharmacology and Neurology, BUSM

I. BACKGROUND AND CHARGE TO COMMITTEE

Propelled by the ongoing revolution in technology and an increasingly interdisciplinary research environment, the life sciences are advancing at an astonishing pace. At the same time, building and sustaining world-class programs in the life sciences is becoming more challenging due to the increasingly sophisticated instrumentation and infrastructure needed to pursue cutting-edge research as well as heightened competition for a shrinking pool of federal funding (Figure 1). The decline in federal funding is particularly problematic for the common medical school model, which relies primarily on external research grants to fund faculty salaries. At Boston University, the life sciences are broadly represented across multiple departments on both campuses. While their academic missions remain distinctive, the expectations for excellence in faculty research are essentially identical and there is significant overlap between our campuses in research interests, as exemplified by recent parallel efforts to recruit new faculty in fields such as neuroscience and systems biology. On the other hand, fundamentally different financial models on the Medical and Charles River campuses result in significant disparities in the institutional resources available to recruit and support outstanding faculty.



Fig. 1. National Institutes of Health annual budget in constant 2016 dollars (American Association for the Advancement of Science, 2016).

Given this background and the importance of allocating limited institutional resources in a manner that maximizes the stature and success of BU's life sciences programs, our committee was tasked with exploring the opportunities and mechanisms for enhancing the level of collaboration and coordination among academic units engaged in basic life sciences research and education. In particular, and as outlined in the charge to the committee from President Brown and Provosts Morrison and Antman, we were asked to address the following questions:

- 1. What are the opportunities for and impediments to closer formal collaborations between basic life science units on the CRC and MED?
- 2. How would the University best organize our efforts to maximize our success in research and education? Do other universities have more effective models than Boston University's?
- 3. What are the implications of any new vision proposed by the committee for faculty appointments on both campuses, facilities, and infrastructure?
- 4. For the plan that emerges, please recommend the sequence of steps the University should take immediately and over the next decade.

II. EXECUTIVE SUMMARY: MAJOR FINDINGS AND RECOMMENDATIONS

The committee focused its efforts around four major topics, each of which was assigned to a subcommittee: 1) the current landscape of basic life science (BLS) research at BU, 2) survey and comparison to other institutions, 3) PhD programs, and 4) faculty recruitment and appointments. The findings of each subcommittee are presented in greater detail below. We summarize our major findings and recommendations here:

Biomedical research in the United States experienced a generation of continuous growth fueled by steadily increasing federal funding from the 1960's through 2003, a period that culminated with a doubling of the National Institutes of Health (NIH) budget from 1998 to 2003. Since then, the NIH budget has experienced a gradual decline in constant dollars with the exception of 2009, when NIH received stimulus funding from the American Recovery and Reinvestment Act (ARRA). Over the same period, technological advances, including increasingly sophisticated instrumentation and infrastructure, have increased the costs of life science research.

These trends represent a significant challenge for all university-based research, but particularly for medical schools that have relied on ample federal funding to support faculty salaries, the researchers who staff their laboratories (graduate students, post-docs, technicians), and through "indirect costs," the buildings and infrastructure needed to support the research enterprise. While the Trump administration's recent proposal to cut \$5.8B from the NIH budget and limit indirect costs to 10% will likely gain little support in Congress, as a statement of priorities, it does not bode well for biomedical research in the coming years.

While all institutions with medical schools are affected by declining federal support, the most striking result from our survey of other institutions is the substantial variation among schools in the magnitude of annual revenue transfers to medical schools from their associated hospitals. In the most extreme case, the Division of Biological Sciences at the University of Chicago receives \$500M annually from their medical center, providing a strong financial foundation that allows them to offer all faculty tenured (or tenure-track), 12-month appointments. The absence of any transfers from Boston Medical Center (an affiliated but independent entity) to Boston University School of Medicine (BUSM) represents a major structural disadvantage for which there appears to be no easy remedy. Like BU, other institutions have increased the number and size of MA/MS programs to generate revenue, and are pursuing research funding from the private sector, including foundations and industry. Endowments and gift income also vary among institutions, but undoubtedly will become increasingly important. For example, the Jerome L. Greene Science Building, which will house 60 neuroscientists at Columbia University, was supported by a single \$250M gift.

Like BU, other institutions are investing in interdisciplinary programs, including research centers and graduate programs that engage groups of faculty with shared and complementary interests from different schools (e.g., medicine, engineering, arts and sciences) and different departments. At BU, there is no question that outstanding investigators are engaged in basic

biomedical research in multiple departments on both campuses, and that there are unrealized opportunities for new interdisciplinary programs and collaborations. On the other hand, we found few examples at other institutions of significant integration between medical schools and other units at the level of undergraduate academic programs; teaching of undergraduates by medical school faculty remains uncommon.

Our committee was provided with data suggesting that the nature of faculty positions on our two campuses have converged in key respects, with increasing expectations for excellence in faculty research on the Charles River Campus (CRC), and increasing teaching commitments and institutional support for faculty salaries in the BUSM basic science departments. The committee accepts these trends in the aggregate, but notes that institutional salary support at BUSM is still somewhat less than in CRC departments and that teaching effort varies considerably both among and within the BUSM basic science departments. Moreover, significant differences persist in the expectations and perceptions of faculty members on the two campuses, with faculty in the BUSM basic science departments accepting greater responsibility for supporting their own salaries in exchange for having more time available for research. While most CRC faculty have full responsibility for teaching two or three semester-long courses per year and thus commit more time to teaching than faculty in at least three of the five BUSM basic science departments, the perceived difference in teaching effort for some junior faculty at BUSM may be greater than the actual difference. This is particularly true if comparing to a CRC faculty member who exercises the option to "buy out" of teaching responsibilities by covering a portion of their salary with external funding.

Perhaps the most important result of our comparison of faculty appointments between the two campuses is the current disparity in institutional resources available to support the recruitment of new faculty. At present, faculty recruitment in the BUSM basic science departments appears to be highly constrained; given the limited resources available to support faculty salary, startup costs and laboratory renovations. As a result, recruitment is currently limited to candidates who have significant external funding in hand (e.g., NIH K99/R00 recipients), as the indirect costs from that funding is the primary source of startup funds. In contrast, similar candidates who are recruited to CRC departments are provided with substantially greater startup funding and are asked to cover much less of their own salary from their grant(s). This puts the BUSM basic science departments at a competitive disadvantage, both within BU and nationally, in recruiting top faculty candidates.

While BU should continue to build its endowment, including the number of endowed chairs, to provide a stronger financial foundation for basic research at the medical school, greater integration of research and education programs across campuses may allow BU to more effectively advance fields of research excellence represented on both campuses. In particular, collaborative hiring of new faculty who would contribute to undergraduate teaching and be jointly appointed in CRC department and a BUSM department would allow the current disparity in resources available for faculty recruitment to be alleviated. The committee discussed at length the possibility of joint hiring and the various challenges and complications

involved. While there are significant concerns about the expectations that would be placed on jointly appointed faculty, **the consensus, but not unanimous view** is that is that BU should develop and test this approach with a coordinated plan for hiring a small group of faculty in a one or more broadly defined fields of recognized or emerging interdisciplinary excellence.

Before presenting more detailed recommendations and an outline for implementation, we highlight a few major considerations and basic principles:

- It is critical that any new initiatives, including joint recruitment of faculty and interdisciplinary academic programs, are defined and strongly supported by faculty on both campuses. At the same time, there needs to be a significant commitment of institutional resources to support these initiatives. Thus, we recommend a combined "top-down/bottom-up" approach in which a general framework and the necessary resources are allocated by the central administration to support faculty hiring and academic program development in selected research fields that are identified and defined by groups of faculty that span departments on both campuses.
- The committee views the physical distance between BU's campuses as a significant challenge and an inherent disadvantage for BU in comparison to institutions with single or adjacent campuses. Regardless of the physical distance, becoming an active member and meeting the expectations of two departments is also a significant challenge. As such, it is critically important that new assistant professors offered joint appointments be enthusiastic about the opportunity to teach undergraduates and that they be provided with extra support and mentorship, particularly as they get started in their careers at BU. Several members of the committee felt that initial efforts to jointly recruit faculty should focus on senior or mid-career faculty, who could more easily handle the challenges of joining departments on two different campuses, but others were concerned that the cost of this approach might be prohibitive. Given the importance of proximity among colleagues with shared interests, we also recommend that laboratory spaces be carefully planned to create co-located groups of faculty that comprise full-time members of participating MED departments along with two or more one jointly-appointed faculty who are members of the same CRC department so that they can share the experience of managing the cross-campus challenge.

Recommended outline for joint recruitment of faculty:

- Provosts Morrison and Antman identify and allocate resources (faculty lines, laboratory space, startup and renovation funding) to support the joint recruitment of at least six new faculty members over the course of 3-4 years. This initial group of faculty hires will provide significant insight into best practices for optimizing the program, and facilitating a potential expansion of joint recruitment efforts in the future.
- 2) Form a faculty advisory committee to foster the development of proposals, advise the Provosts on the selection of one or more research fields for cross-campus development,

advise on any new administrative structures and policies necessary to support and evaluate jointly appointed faculty, and evaluate the success of the overall initiative over time.

- 3) Solicit from the BU life sciences community proposals with the following requirements:
 - a. proposals submitted by faculty groups with membership from both campuses and with the support of one or more departments on each campus
 - b. proposals describe the research field and programmatic goals for one or more collaborative faculty searches
 - c. proposals should also explain how the proposed hiring will support both undergraduate programs and new or existing cross-campus graduate programs.
- 4) Either concurrently or following a trial phase, an alternative track for seeking joint appointments for faculty candidates applying to one of the BUSM basic science departments should also be considered. In this model, a joint appointment in a CRC department would be pursued opportunistically for candidates who are enthusiastic about teaching undergraduates and whose research is synergistic with a CRC department. The administrative framework and conditions under which joint appointments would be considered should be clearly defined *a priori*.

It appears imperative that BU adapt to the long-term decline in federal funding, including the increasing difficulty of recovering the full indirect costs of supporting the life sciences research enterprise. The committee considered the suggestion that joint hiring and participation in undergraduate teaching might become the standard model for most new faculty in the BUSM basic science departments, but it is not clear that this approach is sufficiently scalable to provide a general solution. Given this uncertainty, we emphasize the need to simultaneously pursue other means of increasing the level of ongoing institutional support for medical school faculty and basic life science research.

Summary of recommendations for academic programs:

Academic leaders from other institutions highlighted interdisciplinary graduate programs as an effective means of promoting collaboration and interaction among faculty in different schools and departments. Thus, we also recommend that jointly appointed faculty participate in new or existing cross-campus academic programs, which will have the added benefit of strengthening their own connections to "home" departments on both campuses. Our committee, however, recommends a gradual step-wise process of further developing cross-campus interdisciplinary PhD programs, with an emphasis on developing thematic tracks that might bridge existing departmental programs on each campus. Any proposed changes should maintain the identity and independence of successful PhD programs with ongoing training grant support, and should also avoid the unnecessary proliferation of PhD programs that would generate confusion for applicants and work against maintaining or achieving critical mass in each program.

Additional key recommendations to improve BU's PhD programs in the life sciences:

- Create a unified website that serves as a gateway to all life sciences graduate programs at BU; this is a straightforward objective that can be achieved in the near future.
- Work towards providing fellowship support with no teaching responsibilities for all first-year PhD students to increase BU's competitiveness in recruiting the best applicants.
- Focusing initially on fostering new training grants that engage faculty on both campuses may be a faster and more powerful approach to building cross-campus collaboration than developing new PhD-granting programs. Thus, we recommend increased administrative support for training grant applications and management (e.g., data acquisition and student tracking), ideally with dedicated staff in a centralized office, as well as incentives for faculty to lead these efforts.

Finally, an innovative proposal for what might become a distinctive BU undergraduate program should be further explored. The idea is to develop a "Biomedical Sciences Program" or "Academy" that would provide BU undergraduates with an introduction to special topics in biomedical research and health policy in courses that meet on the medical campus. This might take the form of a semester-long program implementing a block course format and other special events as in the BU Marine Semester. A planning process to determine the ideal program length and structure, course offerings, and faculty responsibilities is needed along with an evaluation of infrastructure and administrative support requirements.