The University of Massachusetts Life Sciences Task Force

FINAL DRAFT REPORT

Positioning the University of Massachusetts as the State-wide Resource for the Commonwealth’s Life Sciences Ecosystem

May 2014
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I. Executive Summary

During the 2013 – 2014 calendar year, Robert L. Caret, PhD, President of the University of Massachusetts, charged Michael F. Collins, MD, Senior Vice President for the Health Sciences and Chancellor of the University of Massachusetts Medical School, with developing a successor System-wide strategic plan for the life sciences.

A number of important and aligned factors contributed to the decision to launch a new life sciences strategic planning process, including the following:

- Major changes in the economy, health care sector and R&D funding environment have markedly changed the landscape for academic institutions, hospitals, government and industry;

- The University has benefitted from the recent addition of many new leaders, both at the System and campus levels, who were not part of the initial life sciences planning process back in 2008, but have the expertise and experience to provide tremendous value to a successor planning process;

- The initial life science strategic plan, which is in its final year, resulted in many substantive accomplishments and generated great momentum that the University could build upon to address emerging realities, opportunities and challenges;

- Given that the University, by virtue of the first planning process, has made inroads in promoting a culture of collaboration within the System, a successor planning process provides the University with a timely opportunity to create a framework within UMass that promotes and sustains external collaborations, especially with industry partners;

- The importance of translational research and the broader external environment, marked by constrained research funding and other pressures, will necessitate the development of innovative programs and solutions, both inside and outside the University, in order to continue to grow the University’s R&D enterprise and take advantage of UMass discoveries.

- As the state’s premier public research university, the UMass System keenly appreciates its central role in helping to fuel the Commonwealth’s innovation economy, particularly in the life sciences sector, across all regions of the state and, therefore, wishes to craft a new plan to increase its impact on the development of life sciences throughout Massachusetts; and

- The significant role the University played in helping to implement the vision of the Massachusetts Life Sciences Initiative, now widely viewed as an undisputed success story for government investment and economic growth, demonstrated the importance of having a coordinated and targeted planning document that is aligned with state government.

Similar to the initial planning effort that took place in 2008, Chancellor Collins, in his role as Senior Vice President for the Health Sciences, formed the UMass Life Sciences Task Force (LSTF), comprised of a

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diverse and senior group of University colleagues representing each of the five campuses and the President’s Office, to serve as the structure from which to organize and facilitate this comprehensive planning process.

The work of the LSTF was guided by three principles:

1) The LSTF’s efforts should build upon the successes of and momentum generated from the initial strategic plan;

2) The work of the LSTF must be supportive of and aligned with the mission of the Commonwealth’s public research university to provide an affordable and accessible education of high quality and to conduct programs of research and public service that advance knowledge and improve the lives of the people of the Commonwealth, the nation and the world; and

3) The LSTF’s recommendations should be focused on strengthening the University’s central and unique role in advancing the Commonwealth’s life sciences ecosystem across all regions of the state.

At the onset of this planning process, the LSTF, to gauge a starting point for its efforts, reviewed the highlights from the previous strategic plan. This review found that the University has made significant and impressive strides in strengthening its life sciences enterprise during the preceding five-year period. The selected highlights that follow, which resulted from the University’s first-ever life sciences strategic plan, demonstrate the importance of and impact generated from a System-wide coordinated strategy.

- **Growing life sciences talent across the UMass System**: as a result of targeted programs, such as professional masters degrees, UMass increased the number of students graduating with life sciences degrees from 1,621 to 2,758 (70%) from 2007-2013.

- **Expanding a robust and impactful life sciences research enterprise**: through strategic investments in research programs, such as the CTSA-supported UMass Center for Clinical and Translational Science, UMass grew its life sciences R&D expenditures from $220 million to $329 million from 2007-2013.

- **Commercializing UMass discoveries**: by leveraging University-derived discoveries and resources, such as MassBiologics of UMass Medical School, UMass averaged $45.5 million in licensing income from 2007-2013, placing the University among the nation’s leaders in generating licensing revenue.

- **Advancing the Commonwealth’s innovation economy in all regions of the state**: approximately $1.2 billion has been committed across the five UMass campuses in life sciences and related facilities, with over $250 million having been invested by the Massachusetts Life Sciences Center, which has supported the construction of the Institute for Applied Life Sciences at Amherst, the Integrated Sciences Building at Boston, the Massachusetts Accelerator for Bio-manufacturing at Dartmouth, the Emerging Technologies and Innovation Center at Lowell, and the Albert Sherman Center at Worcester.
• **Promoting inter-campus collaboration to take advantage of existing and complementary expertise across the University;** through the establishment of life sciences seed funding programs, such as the Life Sciences Moment Fund, which has supported twenty-two inter-campus research projects, UMass encouraged the formation of important and dynamic faculty networks that position the System well for emerging inter-disciplinary opportunities.

• **Orienting the University toward strategic external partnerships;** recognizing the increasing importance of collaborative partnerships, UMass developed and fostered mechanisms for external engagement, including the UMass Innovation Institute and the Mass Green High Performance Computing Center, both of which serve as models for future engagement strategies.

Understanding the accomplishments of the past planning process, as well as the thematic areas to build upon, the LSTF reaffirmed its fundamental commitment to the core missions of education, research and innovation and recognized the importance of continuing strategic capital and programmatic investments. However, the LSTF also had to take stock of the current environment, which would ultimately shape any strategic direction resulting from the successor planning process.

Early on in the planning effort, the LSTF acknowledged that it would be working within a challenging set of financial and political circumstances, very different than those experienced by the initial task force in 2008. At that time, the Commonwealth had launched the $1 billion Life Sciences Initiative, administered through the Massachusetts Life Sciences Center. Since then, federal funding for the life sciences has been in decline, and looks to remain so for the indefinite future. Moreover, the enabling legislation for the Massachusetts Life Science Center (MLSC) is nearing its end date in 2017, with most of the $1 billion dollar life sciences funding already committed. Additionally, competition for global leadership in life sciences now extends to countries in Europe and Asia, which are mobilizing aggressively and launching national initiatives to strengthen their life sciences sectors.

Given this external environment, the LSTF saw that this successor planning process should emphasize the importance of strategic partnerships to mitigate the implications of these circumstances on the University moving forward. The LSTF agreed that such partnerships must involve all of the stakeholders in the life sciences ecosystem, including the federal and state governments, the life sciences corporate sector, and the higher education sector. Fortunately, the Commonwealth, vis-à-vis state government, recognizes the need for investment to sustain Massachusetts’ global leadership in the life sciences. Moreover, the life sciences corporate sector, which is increasingly situating commercial and R&D operations in the Massachusetts super-cluster, also recognizes the need to create partnerships to sustain the ecosystem in ways that are crucial for its success. This is particularly true in areas, such as training and new knowledge discovery, in which companies have depended on the higher education sector developing programs with the aid of federal financial support.

Taken together, the LSTF’s key objective, as articulated in this report, is to define strategies where UMass can continue to play a central role in sustaining the Commonwealth’s global leadership in the life sciences by enhancing life sciences-related academic and research programs for UMass students and faculty, thereby growing and strengthening a crucial component of the state’s innovation economy. By forming new models for partnership with other key stakeholders in the broader life sciences ecosystem, both in Massachusetts and beyond, UMass will be able to effectively meet the important goals endorsed by the LSTF.
With its charge defined and guiding principles developed, the LSTF set about creating an appropriate structure to facilitate the process. To that end, the LSTF organized its efforts into six working groups, which were focused on the following thematic areas: 1) Talent; 2) External Support and Engagement; 3) Discovery Research; 4) Research Across the Translational Spectrum; 5) Inter-campus Collaboration; and 6) Industry Engagement and Entrepreneurship.

Each of the working groups completed a situational analysis of its specific thematic area, developed a vision statement, drafted a series of strategic questions and solicited perspectives and feedback from key constituencies. Similar to the initial planning process, the working groups actively engaged with colleagues and counterparts on each of the five campuses. However, through this planning process, the working groups also reached out to and interacted with important external stakeholders, among them the Massachusetts Biotechnology Council and MassMEDIC, to discuss the following critical areas: medical devices; bioinformatics and health IT; bio-manufacturing; drug development; and entrepreneurship. This engagement process resulted in a more complete and comprehensive series of strategic recommendations for the LSTF’s consideration. Emanating from the groups’ collective efforts were a number of broad, cross-cutting and interrelated themes that serve as the foundation for the LSTF’s strategic goals and objectives found in this report.

For the purposes of the executive summary, the LSTF-endorsed strategic goals included herein can be distilled into three overarching strategic goals with a number of accompanying strategic objectives. These goals and objectives build on and are an outgrowth of the successes of the initial System-wide life sciences planning process. In this successor planning document, the LSTF has deliberately created a University-driven strategic framework, the basic elements of which can and will be pursued through coordinated and targeted investments and structural improvements at the University level.

Recognizing the external environment in which it now operates, the UMass System understands that it must invest internal resources to support life sciences programs, projects and partnerships that advance the institution’s public mission and support the broader priorities set forth by the federal and state governments. Moreover, the University is keenly aware that its future success is dependent, in part, on its willingness to adapt to respond to existing and emerging realities, challenges and opportunities.

With this as context, the strategic framework that follows will enable the University to maximize the impact of its investments relating to life sciences education, training, research and innovation. Indeed, the University System, by virtue of its unique mission and breadth and depth of activities, has and will continue to make substantial, wide-ranging and far-reaching investments in support of the life sciences. Each of the campuses remains committed to offering innovative academic programs to ensure UMass students are prepared to succeed in the Massachusetts innovation economy. Furthermore, the campuses will continue to contribute directly to the Commonwealth’s innovation economy, particularly within the life sciences sector, by recruiting outstanding faculty members who fuel the University’s robust and dynamic research enterprise, which, in turn, drives discovery, creates jobs and fosters commercialization and economic development across the state. Finally, given the size, scope and diversity of the campuses’ R&D efforts, the UMass System will maintain an active program of supporting the construction or enhancement of essential research facilities that enable the campuses to continue to grow life sciences education, training, research and innovation in their respective regions. While these
University-driven commitments will be sustained in the years ahead, the LSTF’s framework will allow the five campuses to make their commitments in a strategic manner, thereby realizing the full value and impact of the University’s collective investments.

Additionally and through this framework, current and anticipated future investments and operational improvements at the University level can benefit the Commonwealth’s life sciences ecosystem. Many of the strategic objectives that follow were developed through the prism of shared investment, strategic alignment mutual benefit. That is to say, the impact of the University’s existing and new life sciences-related investments can be leveraged and, indeed, maximized through a reciprocal relationship with essential external stakeholders, among them state government, the Massachusetts Life Sciences Center and industry groups such as the Massachusetts Biotechnology Council and MassMEDIC. This model of partnership would be founded upon a strong commitment from the University to align its resources, initiatives and investments with those being made by state government, state agencies and life sciences organizations, as well as a clear recognition on behalf of these external stakeholders that the University System is best positioned to serve as the primary partner to strengthen the life sciences ecosystem across all regions of Massachusetts.

**Strategic Goal # 1**

- **Promote the University’s central role in strengthening the Commonwealth’s global leadership position in the life sciences by implementing targeted initiatives that develop talent across the pipeline, from undergraduate educational enrichment strategies to faculty development programs, to meet the dynamic needs of the life sciences sector in Massachusetts.**

**Strategic Objectives:**

1.1 *Strengthen career development services and opportunities*

The LSTF recommends that each of the campuses, in coordination with the System Office, implements a more robust career development services structure, including internship and co-op programs, to create formal linkages with life sciences companies and position UMass students competitively in the life sciences market.

1.2 *Develop academic programs that meet the life sciences sector’s future workforce needs*

The LSTF recommends the formation of key UMass-Industry working groups to consider the creation of new academic programs that have direct links to life sciences industry needs in Massachusetts and, thus, position UMass graduates for long-term success in the workforce.

1.3 *Establish the “Commonwealth Fellows” program to support doctoral students and associates*

The LSTF recommends that the University establish a “Commonwealth Fellows” program to support doctoral students and post-doctoral associates across the UMass System.
1.4 Create term-limited endowed professorships for junior faculty

The LSTF proposes the establishment of a System-wide endowment targeting outstanding junior faculty members, with a special emphasis on strengthening faculty diversity in the life sciences across the University.

1.5 Establish the Presidential Scholars Innovation Fund to support faculty research efforts and innovation

The LSTF proposes the establishment of the Presidential Scholars Innovation Fund, a dedicated fund that would offer prestigious awards for faculty members in support of extremely novel, high risk/high reward research that would be unlikely to receive funding from other sources or bold new areas of inquiry in fundamental discovery research or translational research emanating from prior discovery work.

1.6 Develop and invest in a System-wide student success strategy for undergraduate students in STEM degree programs.

The LSTF recommends that the University develop a System-wide strategy for undergraduate students in STEM degree programs. In conjunction with the System Office, the campuses would be responsible for developing effective and efficient practices in key programmatic areas focused on improving retention rates, graduation rates, time to graduation and academic performance.

Strategic Goal #2

✓ Foster an innovative, collaborative and complementary research enterprise that will enhance the breadth, depth, scope and impact of the University’s R&D efforts.

Strategic Objectives:

2.1 Support the renewal of the University-wide CTSA Grant Award

Considering the central role of the UMass Center for Clinical and Translational Science in building the translational science and training ecosystem at UMass, the LSTF believes that the successful renewal of this major federal grant should be a critical element of the University’s Life Sciences strategic plan over the next five years.

2.2 Expand existing research pilot programs

The LSTF supports increasing the funding for the University’s existing research pilot programs, including the Life Sciences Moment Fund, President’s Science and Technology Initiatives Fund, and Next Hundred Million Doses Pilot Program.
2.3 Coordinate faculty recruitment and research investments in areas of strategic importance

The LSTF recommends the coordination of faculty recruitment and research investments to ensure those investments are aligned with and deployed in areas of strategic importance for the University’s R&D enterprise and the Commonwealth’s life sciences innovation economy.

2.4 Reinvigorate the Commonwealth’s R&D Matching Grant Programs

The LSTF strongly recommends that the UMass System work actively and collaboratively with key stakeholders to reinstate the MLSC’s Research Cooperative Matching Fund and to create a new federal grant matching program for life sciences research, which would complement the state’s existing R&D Matching Fund.

2.5 Establish a support fund to facilitate large-scale grant proposals

The LSTF recommends the creation of a dedicated fund to enable UMass to compete aggressively for federal funding including and especially large-scale, multi-institutional awards, so-called “center-level” grants, which would leverage state investments via matching programs established at the Mass Tech Collaborative.

2.6 Establish a System-wide Research Cores Coordinating Committee & Core Capital Renewal Fund

The LSTF recommends the establishment of a System-wide Research Cores Coordinating Committee that would be charged with reviewing campus assets, setting research core priorities, promoting the efficient and effective use of existing research cores, overseeing the Cores Capital Renewal Fund and fostering shared use of UMass-Industry cores.

2.7 Strengthen System-wide mechanisms that promote faculty networks

The LSTF proposes the University strengthen mechanisms, such as the small conference grant program, that encourage inter-campus and inter-disciplinary collaborative efforts and that promote the continued development of strong faculty networks throughout the UMass System.

Strategic Goal #3

Position the UMass campuses as hubs for industry engagement, technological innovation and regional development that drive the Commonwealth’s innovation ecosystem across all regions of the state.

Strategic Objectives:

3.1 Create a Five-Campus Network of Life Science Regional Innovation Centers

The LSTF recommends that the University’s five campuses serve as a network of life sciences regional innovation centers that promote innovation and the growth of the life sciences industry.
throughout the Commonwealth by strengthening the University’s capacity for effectively, efficiently and reliably engaging with key state-wide and regional partners.

3.2 Launch a Coordinated Public Information and Outreach Initiative that Communicates and Accelerates the University’s Impact on the Commonwealth’s Innovation Economy

The LSTF recommends a public information and outreach initiative to inform key stakeholders about the scope and impact of the University’s research, development and commercialization endeavors.

3.3 Enhance and Expand Campus-based Entrepreneurship and Commercialization Activities

The LSTF recommends a targeted and more robust approach to entrepreneurship and commercialization on the campuses that fosters innovation and entrepreneurship opportunities through incubators, mentorship, business and regulatory development support, and seed funding.

3.4 Create a Life Sciences Investment Fund to Support Innovative and Multi-Campus Research Initiatives

The LSTF recommends the creation of a Life Sciences Investment Fund to support innovative and multi-campus research initiatives that leverage existing and complementary expertise found across the five campuses, as well as fuel the growth of the life sciences ecosystem in all regions of the Commonwealth.
II. Introduction

- **THE UMass LIFE SCIENCES TASK FORCE 2013: BUILDING ON THE SUCCESSES OF THE INITIAL PLANNING PROCESS TO POSITION THE UNIVERSITY TO MEET EMERGING CHALLENGES AND OPPORTUNITIES**

The University of Massachusetts is the Commonwealth’s public land grant university, having recently celebrated its 150th year of service to the Commonwealth and all its diverse regions.

The mission of UMass is: to provide affordable and accessible education of high quality and to conduct programs of research and public service that advance the knowledge and improve the lives of the people of the Commonwealth, the nation and the world.

Over the past decade, the University has given special priority to its development as a top-tier research university, and it has made significant and impressive strides in this regard. In 2013, UMass ranked third in Massachusetts, fourth in New England and thirty-third nationally in terms of annual R&D expenditures\(^2\). Moreover, UMass continues to cement its leadership position in technology licensing income, ranking fifteenth in this important metric among all U.S. institutions.

**The University’s First Strategic Plan in the Life Sciences**

In 2006, UMass achieved a great milestone with the awarding of the Nobel Prize in Medicine or Physiology to Dr. Craig Mello, Blais University Chair in Molecular Medicine at the UMass Medical School, for his co-discovery of RNA interference. Also in 2006, Deval Patrick was elected Governor of Massachusetts and, early in his administration, he outlined an ambitious vision and made a commitment to the development of the life sciences cluster in the Commonwealth.

Then in 2007-2008, under the leadership of Medical School Chancellor Michael Collins, the University organized a System-wide task force to develop the University’s first-ever strategic plan in the life sciences. This effort resulted in a well-conceived plan to guide the University’s development in the life sciences for a five-year period from 2008-2013.

The plan produced three mission-related recommendations (talent, research, innovation) and four implementation-related recommendations (a Center for Clinical and Translational Science, Life Sciences-specific Seed Funding, New Collaborations and Partnerships, and Strategic Capital Investments).

During the period of 2007 to 2013, the following has been accomplished in the mission-related recommendations:

- **Talent** – the number of life science-related degrees increased from 1,621 to 2,758 (70%) across the UMass System;

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• **Research** – life science R&D expenditures grew from $220 million to $329 million (50%) across the UMass System;

• **Technology commercialization** – R&D annual licensing revenue across the UMass System averaged $45.5 million, with a peak year of $71 million due to a license with Merck for treating *C. difficile* infection;

• **Innovation** – over a dozen new innovation centers were established or expanded across the state in fields ranging from medical devices and personalized cancer therapy to bio-manufacturing (many of these were financially supported by the Massachusetts Life Sciences Center).

In addition, the following was accomplished in the implementation-related recommendations:

• **Translational research model** – the Medical School led a successful five-campus initiative to win a five-year $20 million Clinical and Translational Sciences Award (CTSA) from the NIH, one of only 62 in the U.S.;

• **Seed Funding** – the Medical School established the “Life Sciences Moment Fund” and the President’s Office continued its Science & Technology Initiatives Fund to seed new efforts in the life sciences;

• **Collaborations** – the most dramatic new collaboration was the CTSA multi-campus collaboration, but the University also initiated partnerships with private universities and research institutes (e.g., MGHPCC in Holyoke, CPCT at Boston, PVLSI in Springfield) and industry (e.g., Amherst with Abbott/BASF, Medical School with Pfizer, Lowell with Boston Scientific);

• **Capital investments** – about $1.2 billion has been committed across the five campuses in life sciences and related facilities (with over $250 million provided by the Massachusetts Life Sciences Center through 2013).

It is important to note that the implementation of this previous five-year life sciences strategic plan coincided with the passage and implementation of the Massachusetts Life Sciences Initiative, a $1 billion combination of capital investments and tax breaks designed to enhance economic development in the Commonwealth’s life sciences sector. Each of the UMass campuses played a significant role in carrying out the vision of the Life Sciences Initiative, and the success enjoyed by the University was clearly facilitated by this alignment with the state government. Similarly, the previous plan has helped to advance alignment among and between the five UMass campuses, which is highly synergistic and just now being regularly exploited for the benefit of the System, as well as for Massachusetts. Some enduring physical and programmatic resources that have been put in place promise to yield future successes in the life sciences.

Clearly, over the past several years, the University of Massachusetts – with a strategic direction, targeted hiring of world-class faculty, major investment of its own resources, substantial financial support from the MLSC, increased and synergistic collaboration across the campuses and a conscious focus on translational research – has positioned itself as a major asset for the life sciences ecosystem in Massachusetts. This was confirmed in the Massachusetts Biotechnology Council’s recently published strategic plan entitled, “Impact 2020: Advancing Massachusetts Leadership in the Life Sciences for
Patients\textsuperscript{3},” which highlighted the University’s unique and essential position within the Commonwealth’s life sciences community. The following excerpt from the Biotechnology Council’s Impact 2020 report captures the importance of and appreciation for the University’s strategic direction in the life sciences during the previous five-year period.

“UMass’ support of the life sciences through talent development and strategic investments is a prime example of a highly motivated institution with vast resources, committed to helping the state of Massachusetts remain a leader in the field.”

New Strategic Directions

The University of Massachusetts, as the state’s public research university, remains committed to continuing to develop and strengthen its life sciences-related education, training, research and entrepreneurial activities through further strategic investments on the campus and key hiring of world-class faculty.

But, the broader environment in which the University operates has changed substantially since the initial life sciences plan was crafted. The U.S. economy has experienced a number of challenges, resulting in unpredictability and variability. After years of healthy growth, federal support for biomedical research through the NIH and other agencies is in decline and faces an uncertain future in the current political environment. Major life sciences companies are approaching research and development efforts in different ways and developing new kinds of relationships with universities. For instance, a recent study points out that “As life science companies re-engineer R&D, the well-documented trend toward external partnerships within the U.S. continues. International collaboration still is less common: nearly 60% have no plans for specific foreign engagement.”\textsuperscript{4} Finally, the Commonwealth will elect a new Governor in the coming year, and the prospects of continued state support for the life sciences are uncertain.

With this as context, Robert Caret, PhD, President of the University of Massachusetts, charged Chancellor Michael F. Collins, in his role as Senior Vice President for the Health Sciences for the University System, to lead a five-campus planning process focused on the life sciences during the 2013 – 2014 Calendar Year.

To facilitate the planning process, Chancellor Collins reconstituted the UMass Life Sciences Task Force (LSTF), which served as the essential structure for the development of the University’s inaugural System-wide life sciences strategic plan back in 2008. The LSTF membership was comprised of a rich and diverse group of colleagues from across the UMass System representing the full breadth and depth of the institution’s mission-related activities. A list of the membership, organized according to campus affiliation, is included in the appendix. Furthermore, Chancellor Collins formed a smaller leadership

\textsuperscript{3}Massachusetts Biotechnology Council’s “Impact 2020: Advancing Massachusetts Leadership in the Life Sciences for Patients”
\textsuperscript{4}2014 Global R&D Funding Forecast, Battelle, December (2013).
committee from among the ranks of the LSTF membership to help guide the process from a strategic level and to ensure proper coordination among the campuses. The representatives to the LSTF Stewardship Group, which played an instrumental role in the development of this final report and deserve special mention, were:

- (Amherst campus) Michael Malone, PhD, Vice Chancellor for Research and External Engagement
- (Boston campus) Andrew Grosovsky, PhD, Dean, College of Science and Mathematics
- (Dartmouth campus) Paul Vigeant, Assistant Chancellor for Economic Development
- (Lowell campus) Julie Chen, PhD, Vice Provost for Research
- (Worcester campus) Terence Flotte, MD, Executive Deputy Chancellor, Provost, Chief Research Officer and Dean, School of Medicine
- (President’s Office) Tom Chmura, Vice President for Economic Development

For additional information on the LSTF’s work process, please see the ‘work plan’ section in the appendix.
III. Strategic Goal – Talent

Promote the University’s central role in strengthening the Commonwealth’s global leadership position in the life sciences by implementing targeted initiatives that develop talent across the pipeline, from undergraduate educational enrichment strategies to faculty development programs.

Introduction

The LSTF acknowledges the University’s fundamental and unique role in educating the Commonwealth’s future STEM-related workforce and, therefore, recommends that the University implement specific strategies, including the development of specialized degree programs, experiential learning opportunities and career development services, which will enable an increasing number of UMass graduates to find success in and add value to the state’s life sciences innovation ecosystem.

The LSTF talent development strategy recognizes the importance of initiatives that span the talent pipeline, from undergraduate and graduate students through to postdoctoral fellows and faculty members. By enhancing life sciences education, academic programs, training and professional development at all levels, the UMass System will contribute significantly to the vitality and sustainability of the Commonwealth’s dynamic life sciences ecosystem. Indeed, the University’s talent is Massachusetts’ life sciences workforce. Over four-fifths of UMass undergraduates are Massachusetts residents, compared with approximately a quarter at private universities across the state. Moreover, UMass is responsible for awarding approximately 15% of all baccalaureate and graduate degrees in the state. Of particular note, nearly two-thirds of the University’s graduates remain in the Commonwealth after graduation. Consequently, any strategies focused on building a larger, more diverse and better trained pool of candidates for advanced degrees in STEM disciplines within the UMass System will, ultimately, contribute to the long-term growth of the state’s life sciences sector.

In order to have an effective and efficient talent development strategy and to be recognized as a national and international leader in developing talent for the life sciences sector, UMass must vigorously pursue initiatives that enrich the educational and professional experiences at all levels of the talent pipeline. Central to this strategy is a robust focus on improving the success of the University’s undergraduate students in STEM degree programs. Given that UMass students are the Commonwealth’s future workforce, it is imperative to invest in the beginning of the University’s talent pipeline, and the University does have some models to build on, including UMass Boston’s highly effective Student Success Center within the College of Science and Mathematics\(^5\) and UMass Amherst’s STEM Diversity Institute\(^6\). Moreover, given the profound role faculty play in educating, mentoring and training these students, it is essential that the talent development strategy be broadened to include life sciences faculty as well. Finally, given the reality that the University’s students graduating from STEM degree programs will be the Commonwealth’s future life sciences workforce, the System’s talent development strategy must extend beyond the five campuses and include the meaningful engagement of key industry stakeholders.

\(^5\) UMass Boston’s Student Success Center: [http://www.umb.edu/academics/csm/student_success_center](http://www.umb.edu/academics/csm/student_success_center)

\(^6\) UMass Amherst’s STEM Diversity Institute: [http://www.umass.edu/sdi/](http://www.umass.edu/sdi/)
With this as context, the LSTF recommends the following strategic objectives, which are aligned with and support the implementation of the goal of promoting the University’s central role in strengthening the Commonwealth’s global leadership position in the life sciences.

**STRATEGIC OBJECTIVES**

1.1 **Strengthen Career Development Services and Opportunities**

The LSTF recommends that each of the campuses, in coordination with the System Office, implements a more robust career development services structure to create linkages with life sciences companies and to position UMass students competitively in the life sciences market.

Although some of the UMass campuses are showing signs of improving career development services, historically, the UMass System has lagged behind other Massachusetts institutions such as Northeastern and Worcester Polytechnic Institute, both of which have well-developed and well-regarded internship and co-op programs. Through this planning process, the LSTF has found that life sciences companies are, indeed, interested in these pipeline programs and would view the UMass campuses as logical partners to discuss such collaborative efforts.

A System-wide undergraduate internship program, for example, could include a coordinator position at the President’s Office and dedicated senior staff positions on the campuses. Through internships, employers form strong relationships with student interns as a result of hands-on, mentored work that frequently extends beyond the formal internship to professional employment. Moreover, internships offer students the opportunity to apply their knowledge and expand their skills beyond structured classroom and laboratory experiences. Finally, over time, important relationships develop between UMass faculty members and company scientists who host UMass interns, leading to further productive interactions.

A System-wide coordinated program of “mutual internships” in the life sciences could: supplement industry supported stipends for on-site work through need-based cost of living/transportation allowances; extend the timeline into the post internship semester/year with matching funding (equal to the industry stipend) for specific project work mentored by the company; fund on campus follow-on research projects supervised by faculty; and provide a paid “pre-internship” experience at both a UMass campus and industry sites for students accepted into UMass life sciences majors with an AS degree from a Massachusetts community college.

1.2 **Develop academic programs that meet the life sciences sector’s future workforce needs**

Based on input received from engagement with industry stakeholders, the LSTF recommends the formation of key UMass-Industry working groups (i.e. bio-pharma; medical device; bio-manufacturing; bio-IT) to consider the creation of new academic programs that have direct links to life sciences industry needs in Massachusetts and, thus, position UMass graduates for long-term success in the workforce.

One such program that could be implemented immediately is a certificate and degree program in regulatory science. A certificate or Master’s degree can build on more traditional degrees without great expense and can contribute substantially to the success of UMass graduates. Currently, no public college
within the state offers such a degree program, and industry stakeholders have identified the lack of qualified regulatory science graduates as a major restriction in their growth.

Regulatory Science is a critical component of moving basic discoveries into a whole host of commercially viable and impactful products, such as drugs, biologics, devices, diagnostics, cosmetics, food and environmental biotechnologies. The United States is the largest market for biotechnology (medical, agricultural, and industrial) in the world with more than 1,300 companies and 5.5 million employees. Massachusetts is a leader in biotechnology research and development and, in 2010, Massachusetts biotechnology companies received 23.1% of all U.S. venture capital. Massachusetts funding by the NIH per capita exceeds other states and is home to the top five NIH-funded research hospitals in the U.S.

Taking advantage of internal resources, including the state's only public law and medical schools and educational programs that include business, nursing, public health, engineering, basic science, informatics, systems biology, food science, agriculture, and environmental studies, UMass can work with the Massachusetts life sciences sector to develop and deliver certificate and degree programs in Regulatory Science.

(a) **Graduate Certificate in Regulatory Science**: A certificate program could be offered by UMass schools that would be developed into a Master’s degree program and an undergraduate program that could be an intercampus collaboration and include online programming.

(b) **Master’s in Regulatory Science**: A Master’s in Regulatory Science would be designed to prepare scientists, health care professionals, engineers, and managers to competently navigate the regulatory requirements in the biotechnology industry. The program would be focused on small to mid-sized companies and would distinguish itself from other similar programs by (1) its focus on substantive knowledge of regulatory frameworks and skills in finding, developing, interpreting and applying new regulations; (2) a focus on risk management, business decisions, strategic advancement, product development, marketing, industrial scaling and engineering controls; (3) team taught introductory and capstone courses that emphasize the integration and dynamic interplay of multiple disciplines in successful transition from discovery to commercialization; (4) its branching curriculum to meet the needs for those with undergraduate degrees or employment in business, law, engineering, science, and health professions; (5) its inclusion of required internship or research project in the final semester integrating theory and practice, knowledge and skills.

1.3 Establish the “Commonwealth Fellows” Program for Doctoral Students and Associates

The LSTF recommends the creation of a “Commonwealth Fellows” program to support doctoral students and post-doctoral associates across the UMass System.

The biotechnology sector in Massachusetts employs more individuals than similar industries in any other state, and has grown by 40% in the last ten years. Expanding and strengthening the talent pool to satisfy this growth require robust graduate and postdoctoral programs that can attract highly qualified graduate students and Ph.D.-level researchers to the UMass campuses. These students and post-doctoral scientists represent a critical component of the talent pipeline required to satisfy the workforce needs of the state’s innovation ecosystem.
These personnel are also the primary student and staff members who sustain life sciences research projects within faculty laboratories on the campuses. Without a steady stream of high quality students and graduates, it would be difficult for the five-campus System to sustain the research and development efforts demanded by a fast-moving state-wide life sciences industrial complex. Better quality graduates and post-doctoral associates translate into a high quality workforce that is more likely to perpetuate productive relationships between industrial partners and UMass faculties in the future.

The University System, in general, and the Worcester campus, in particular, already offer specially designed programs to doctoral students interested in non-traditional careers (i.e. non-academic careers). The Medical School’s recent NIH BEST grant award\(^7\) to help train doctoral students for careers in industry points to the University’s increasing focus on providing its graduate students with a strong foundation from which to succeed in the state’s life sciences sector. By modestly increasing the University’s current investment in supporting graduate education and post-doctoral training, the UMass System will not only enhance its talent pipeline and research enterprise, but also will contribute to a healthy and vibrant life sciences workforce for years to come.

This commitment will encourage applicants to consider applying to UMass for education and training programs. Moreover, by branding the recipients of this competitive fellowship program “Commonwealth Fellows,” it elevates the recognition and prestige associated with the award, thereby generating increased awareness, attention and interest in the program. Each campus will have the opportunity to competitively select candidates for the Commonwealth Fellows Program. The selected fellows, along with their mentors, would be required to participate in an annual symposium intended to bring faculty and students together to facilitate scientific exchange and interaction between all the campuses.

1.4 Create term-limited endowed professorships for junior faculty

The LSTF proposes the establishment of a System-wide endowment targeting outstanding junior faculty members, with a special emphasis on strengthening faculty diversity in the life sciences across the University. Through this initiative, five separate endowments (one per campus) would be created to provide personnel and operating funds for one exceptional junior faculty member on each of the campuses.

Each endowment would enable each campus to recruit and retain one promising junior scholar into an endowed assistant professor position. The endowment stipend would be used during the period when the endowed assistant professors hold this appointment and until the time they are promoted to associate professor. The position will then be vacated and made available to recruit a new outstanding junior faculty member. This program will accord these junior faculty colleagues a high level of prestige as well as a moderate stream of funding to support their scholarship. Moreover, these young faculty members will form a network of thought leaders across the System furthering the prominence of UMass in the life sciences nationally and internationally. This renewable resource would become an important new mechanism to strengthen the System’s ability to recruit and retain top candidates in the field. These positions could also potentially be used to create a long-lasting positive impact on increasing faculty diversity.

1.5 Establish the Presidential Scholars Innovation Fund to Support Faculty Research Efforts and Innovation

The LSTF proposes the establishment of the Presidential Scholars Innovation Fund, a dedicated fund that would offer prestigious awards for faculty members in support of extremely novel, high risk/high reward research that would be unlikely to receive funding from other sources or bold new areas of inquiry in fundamental discovery research or translational research emanating from prior discovery work.

The campuses would identify deserving faculty members for this recognition, and they would use this funding opportunity to incentivize inter-campus collaboration around an issue of strategic importance. Recipients of these awards would be named “Presidential Scholars,” and they would receive funding (perhaps $150,000) to pursue their research objectives. The Presidential Scholars would be required to present the results of their innovation projects at an intercampus symposium at the end of each year of the program.

1.6 Develop and invest in a System-wide student success strategy for undergraduate students in STEM degree programs.

The LSTF proposes the development of a System-wide student success strategy focused on the University’s undergraduate students in STEM degree programs.

In order to have an effective and efficient talent development strategy and to be recognized as a national and international leader in developing talent for the life sciences sector, UMass must vigorously pursue initiatives that enrich the educational and professional experiences at all levels of the talent pipeline. Central to this strategy is a robust focus on improving the success of the University's undergraduate students in STEM degree programs. Retention and graduation rates are of particular national concern in STEM disciplines, since current data shows them to be far below those in other fields.

The majority of the UMass student body hails from Massachusetts and has a strong motivation to stay in Massachusetts, thus creating a nucleus of the workforce for the Massachusetts’ life sciences industry. There is a great degree of probability that many of them would choose to go for further training to become advanced members of this workforce and the future leaders of the life sciences industry in Massachusetts.

To make this positive trend sustainable, the LSTF believes that the University should invest at the front-end of this process as the students enter the System. At the campus level, there already exists a foundation from which to build on as evidenced by the effectiveness of UMass Amherst’s STEM Diversity Institute and UMass Boston’s College of Science and Mathematics’ Student Success Center. Given UMass Boston’s outstanding record of achievement in improving student success, the campus has garnered the support of an external partner, Genzyme, a Sanofi company, which has contributed $1 million to UMass
Boston’s Student Success Center\textsuperscript{8}. Genzyme’s donation is a wonderful example of how a campus-based investment that is very much aligned with the interest of industry partners can be leveraged to attract external support. Additional resources should be made available to the campuses, so that they can strengthen their student success programs, initiatives, and ongoing practices and, by so doing, perhaps attract philanthropic support. Campuses would be charged with developing student success approaches tailored to their circumstances and responsive to campus-specific strategic and programmatic objectives.

The UMass System will play an instrumental role in setting overall goals, providing resources necessary for the successful institutionalization of effective and efficient practices in key programmatic areas and measuring campus-based results. The campuses will be ultimately responsible for the positive outcomes and in charge of identifying and implementing best-fitted evidence-based approaches and practices, and creating mechanisms for communication. The indicators of success from which to measure effectiveness would include:

- Improved retention rates;
- Improved graduation rates;
- Improved time to graduation;
- Improved academic performance; and
- Student participation in academic enhancement activities.

\textsuperscript{8} UMass Boston News Article, “Sanofi gives UMass Boston $1 Million in Support of Student Success Program for STEM Education:” 
http://www.umb.edu/news/detail/sanofi_gives_umass_boston_1_million_in_support_of_student_success_program
IV. Strategic Goal – Research

FOSTER AN INNOVATIVE, COLLABORATIVE AND COMPLEMENTARY RESEARCH ENTERPRISE THAT WILL ENHANCE THE BREADTH, DEPTH, SCOPE AND IMPACT OF THE UNIVERSITY’S R&D EFFORTS.

INTRODUCTION

Over the course of the last decade, the University of Massachusetts, as the state’s premier public research university, has given special priority to its development as a top-tier research university of national and international renown. To this end, the University has recruited a number of outstanding faculty researchers in targeted areas, developed cutting-edge and innovative research programs and embarked on a period of tremendous capital investment, fueled, in part, by the Massachusetts Life Sciences Initiative.

These investments, taken together, have helped to strengthen the University’s research enterprise, especially in the life sciences. From 2007 to 2013, the University’s life sciences R&D expenditures grew from $220 million to $329 million and overall research expenditures increased from $397 million to $591 million (56% of which comes from life sciences research expenditures). During this period of impressive growth, the University has made direct and immediate contributions to the broader economic and social development of the Commonwealth via a robust research portfolio, which, in 2013, was ranked 3rd in Massachusetts and accounted for more than 18% of total R&D expenditures for Massachusetts institutions. Moreover and in 2013, UMass ranked 4th in New England and 33rd nationally with respect to annual R&D expenditures. Finally, the University continued generating significant income from its commercialization efforts, averaging $45.5 million annually in licensing income from 2007 to 2013, which placed UMass in the top 15 nationally in this category.

The broader environment that made this period of sustained growth possible has changed substantially. The U.S. economy has experienced a number of challenges, resulting in unpredictability and variability. After years of healthy growth, federal support for biomedical research through the NIH and other agencies is in decline and faces an uncertain future in the current political environment. Major life sciences companies are approaching research and development efforts in different ways and developing new kinds of relationships with universities. Finally, the Commonwealth will elect a new Governor in the coming year, and the prospects of continued state support for the life sciences are uncertain.

Already, this changed environment is challenging the University’s continued growth in its research enterprise. In FY’13, UMass, similar to other institutions, experienced its first decline in R&D expenditures after many years of consecutive increases. While the 1.1% decline was likely modest compared to other universities, it may be a harbinger of an increasingly constrained funding environment in the years ahead. The impact of federal funding declines on the University’s research enterprise is further compounded by the System’s difficulties in attracting industry R&D support. From FY’10 to FY’13, this critical source of revenue has declined from $15.7 million to $10.6 million, a 32.6% decrease, and currently represents only 8% of the System’s R&D portfolio.
The University remains committed to expanding an innovative and impactful life sciences research enterprise. Despite the recent external challenges, the UMass System continues to be uniquely positioned to utilize the strengths of faculty across disciplines and campuses to shape comprehensive and collaborative responses to current and future research opportunities and problems. Furthermore, the University has and will continue to play a key role in sustaining the state’s position in the life sciences, with $329 million in research expenditures in FY’13.

The strategic objectives that follow take advantage of existing University strengths and anticipated future opportunities from federal funding agencies, including the NIH and NSF, as well as AHRQ, DARPA, PCORI, DOE and MCHB. Additionally, the objectives strategically position the University favorably for research partnerships with the biotech sector in Massachusetts, where all of the top ten global biotech companies are represented. In the years ahead, such partnerships will be a critical resource for the University.

**STRATEGIC OBJECTIVES**

2.1 **Support the renewal of the University-wide CTSA Grant Award**

The LSTF recommends that the University make every effort to ensure the successful renewal of the Clinical and Translational Science Grant Award from the NIH.

A key recommendation of the 2008 UMass Life Sciences Task Force was the establishment of the University of Massachusetts Center for Clinical and Translational Science (UMCCTS) as a new vehicle for System-wide collaborative R&D and education. The Center, which was initially supported with institutional funds, received an NIH Clinical and Translational Science Award (CTSA) Development Award in 2008. This subsequently led to a successful application for a five year, $20 million CTSA award which began in July 2010 to create an academic home for clinical and translational science across all five UMass campuses. The goals of the UMCCTS are: 1) To accelerate the translation of basic discoveries into practical, cost effective solutions that improve human health; and 2) To develop and support the next generation of leaders in clinical and translational research.

Since NIH funding began in 2010, the UMCCTS has played a vital role in linking over 900 members across the five campuses to collaborate around clinical and translational research and education. The annual UMCCTS retreat has consistently grown in size and scope to include over 350 participants in 2013. Similarly, pilot funding programs, in particular the Life Sciences Moment Fund (LSMF), have catalyzed the formation of new teams of investigators from multiple campuses, with excellent return on investment. As of October 2013, the LSMF has invested in twenty-two inter-campus projects, and the award recipients represent twenty-eight different departments across the UMass System, highlighting the diverse and complementary nature of the University’s R&D enterprise.

Over the past five years, the UMCCTS has steadily built an ecosystem that supports the translation of UMass discoveries into products for clinical use. MassBiologics remains a unique and premier facility for biologics discovery, production, and contract manufacturing. Recent UMass System and state funding will support a new cGMP viral vector facility that capitalizes on our world-class gene therapy program. The UMCCTS-Mass Biologics Next Hundred Million Dose Pilot Grant Program provides an

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9 UMass Center for Clinical and Translational Science: [http://www.umassmed.edu/cts/index.aspx](http://www.umassmed.edu/cts/index.aspx)
opportunity for investigators at any UMass campus to partner with MassBiologics personnel on product discovery and development; this new program has garnered thirty-four applications and provided seven awards since its inception in 2013.

The Massachusetts Medical Device Development (M2D2) Center\(^\text{10}\) leverages the engineering and business strengths of the Lowell campus, along with the clinical and biomedical research strengths of the medical school to provide early stage inventors and established Massachusetts-based companies with easy, affordable access to services that move new medical devices from concept to production. Founded in 2008 with approximately $5 million of University and State Funds, M2D2 operates a 14,000 square foot incubator facility that can host twelve client companies in a combination of wet lab, open collaboration, and office space. M2D2 has assisted 100 medical device companies to raise over $24 million in private investment funds and $5 million in grants, and sponsors an annual new venture competition. Over 37 students have interned with M2D2 since its inception. In March 2014, the Massachusetts Life Sciences Center invested an additional $4 million in M2D2 to create the Big Company/Little Company Innovation Hub, which will allow the M2D2 initiative to offer even more services to medical device and biotech start-ups.

New ventures on the Worcester (MAsSTERi) and Amherst (IALS) campuses will improve the System’s ability to develop and deliver drugs based on small molecules and nucleic acids. The LSTF anticipates that this ecosystem will not only allow successful development of products and spinoff companies, but should also provide extensive opportunities for industry engagement and economic development, as well as the development of novel educational and training programs.

The UMCCTS also provides infrastructure and consultative services in the areas of biomedical informatics, community engaged research, clinical and translational research cores, and library access to investigators across the UMass system.

Considering the central role of the UMCCTS in building the translational science and training ecosystem at UMass, the LSTF believes that the successful renewal of this major federal grant should be a critical element of the University’s Life Sciences strategic plan over the next five years. The current grant will enter the NIH competitive renewal process in 2015. It is critically important that the University retain this federal funding to maintain and build upon the momentum that UMass has gained over the past few years. As the University prepares the CTSA grant renewal submission, it may be beneficial to further engage the UMCCTS’s industry partners and to explore the possibilities of entering into new partnerships with entities like the Massachusetts Life Sciences Center on the development of the next phase of the grant award.

A number of exciting projects are underway at the UMCCTS, including plans to augment institutional capacity to develop products in both the T1 (pre-clinical to clinical development, including small molecule therapeutics, biologics, devices, diagnostics, and nucleotide-based therapeutics) and T2+ (evidence-based deployment of best practices and population-based research) arenas. By continuing to build capacity for clinical and translational research throughout across the five campuses, the UMass System will help to develop products that improve the health of citizens of the Commonwealth and the world, while also generating important economic benefits for the state.

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\(^{10}\) M2D2: [http://www.uml.edu/research/centers/m2d2/default.aspx](http://www.uml.edu/research/centers/m2d2/default.aspx)
2.2 Expand Existing Research Pilot Programs

A major recommendation emanating from the initial life sciences strategic plan was the creation of life sciences specific seed funding. As noted above, these funding programs have been tremendously successful, both in terms of connecting faculty members at different campuses and leveraging additional external funds. Given this, the LSTF supports increasing the funding for the University’s existing research pilot programs, including the UMCCTS Life Sciences Moment Fund, President’s Science and Technology Initiatives Fund, and MassBiologics Next Hundred Million Doses Pilot Program. These programs promote interdisciplinary research and inter-campus collaboration as they specifically require collaboration between investigators from at least two campuses and at least two discrete fields, such as engineering and biology, or chemistry and medicine. In addition, they allow investigators to develop preliminary data and publications that can be leveraged for external funding. It is anticipated that funded projects will contribute to the pipeline of products developed from UMass discoveries and the translation of UMass science for clinical use and population health, resulting in direct patient/population benefit and increased licensing revenues for UMass.

2.3 Coordinate Faculty Recruitment and Research Investments in Areas of Strategic Importance

The LSTF recommends the coordination of faculty recruitment and research investments to ensure those investments are aligned with areas of strategic importance for the University’s R&D enterprise. Given that the campuses will continue to make investments in research faculty, research programs and research infrastructure, the University will need to ensure that increasingly limited campus resources are deployed strategically and with the maximum impact on the System’s research enterprise and the state’s innovation economy.

The LSTF believes that the University should direct these investments to areas of strategic opportunity in basic science research and translational and population-based research across the five campuses. To this end, the LSTF has compiled a list of strategic areas in the life sciences that should be the focus of the University’s research investments in the years ahead (please see section C in the Appendix for a complete list of priority areas). The targeted areas for future investment reflect the tremendous depth and diversity of the University’s research enterprise and include fields such as nucleic acid, protein, developmental, evolutionary and systems biology, bio- and health-informatics, drug discovery and delivery, health economics, health disparities research, genetic epidemiology and comparative effectiveness research, among others.

These particular areas and a number of others referenced in the Appendix were identified based on existing strengths, ongoing initiatives, and future opportunities presented by the external environment. The emphasis on nucleic acid biology reflects the tremendous innovation in RNAi at UMass, punctuated by the 2006 Nobel Prize in Medicine or Physiology awarded to Professor Craig Mello and ongoing efforts in RNA therapeutics, gene therapy, epigenetics, and microbiomics across the University. New opportunities in protein biology have been opened up within the context of the Models to Medicine Center within UMass Amherst’s Institute for Applied Life Sciences (IALS)\(^\text{11}\), which has focused on human and veterinary diseases caused by misfolded proteins, while other protein structure-based initiatives are being developed to address problems in drug resistance and structure-based drug design.

\(^{11}\) UMass Amherst’s Institute for Applied Life Sciences: [http://www.umass.edu/ials/](http://www.umass.edu/ials/)
The complexity of modern nucleic acid biology and protein biology come together in the emerging discipline of systems biology, which is critically dependent on computational sciences. Examples of ongoing UMass initiatives in the computational sector include UMass Boston’s Bioinformatics and Center for Personalized Cancer Therapy initiatives, the inter-campus efforts in the use of the Massachusetts Green High-Performance Computing Cluster (MGHPCC) and the Medical School’s new Program in Systems Biology. Developmental biology and aging both bring together aspects of complex mechanisms of gene regulation over the life span. Researchers at UMass have been pursuing these fields along the entire translational continuum, from the most basic studies of 3-D chromatin structure to studies of broad clinical and public health impact.

Evolutionary biology has been and promises to be an important area for contribution by UMass faculty investigators, with ramifications ranging from broad environmental impact to the emergence of antibiotic resistant organisms in hospitalized patients. In similar fashion, UMass researchers in neurobiology have made seminal contributions ranging from the most fundamental aspects of neuronal development in insects to a detailed understanding of the pathobiology of neurodegenerative diseases of humans. Finally, materials science promises to bring together the disciplines of engineering, medicine, chemistry and biology, in ways that are being exploited at each of the five campuses, particularly through intercampus collaborations such as M2D2 and the IALS Center for Personalized Medicine.

Similarly, the translational areas highlighted above build on existing strengths across the five campuses and target areas in which added expertise would best allow the UMass System to grow in the rapidly changing life sciences environment. Health economics is fundamental to understanding the impact of major policy upheavals such as the Affordable Care Act and then to intervening in the health policy arena. The faculty in the Department of Economics on the Amherst campus and the health services researchers in the Department of Quantitative Health Sciences (QHS) on the Worcester campus are well poised to collaborate in this area. Comparative effectiveness research is an emerging area within health services research that is critical to generating the evidence base for therapeutic choices. Moreover, comparative effectiveness research is the focus of the new national multi-billion funding source that is the Patient-Centered Outcomes Research Institute (PCORI). The Worcester campus has already been successful in attracting three of the initial fifty pilot grants funded by this new agency. Similarly, as an increasing number of diagnostic and therapeutic approaches to improve health are developed, and as “personalized medicine” becomes a reality, rigorously measuring the human benefit of new approaches and interventions to the individual person becomes imperative. Outcomes measurement science is an essential component of this emerging field of study. On the other hand, implementation science is also needed in order to learn how to transform health systems so that the knowledge generated across the entire health sciences spectrum can be systematically converted to human benefit.

Health disparities research responds to a major national need as recognized by the NIH and the Institute of Medicine, among many others. The Boston and Worcester campuses have successfully collaborated on obtaining a highly competitive NIH-funded Center for Health Disparities Research12. Becoming one of the nation’s leaders in this arena is within the University’s reach, but requires expansion of UMass’s human capacity in this area. Furthermore, genetic epidemiology offers an important bridge between the basic and population sciences, building on the existing synergy between the School of Public Health on the Amherst campus and QHS on the Worcester campus. Advanced

12 The UMass Center for Health Equity Intervention Research: http://www.cheir.org/
biostatistical modeling underpins most serious population research efforts, and although the University has capacity in this area, especially on the Amherst and Worcester campuses, much more is needed to develop innovative methods and take the University’s methodological research to the next level.

The twenty-three strategic areas of opportunity (please refer to section C in the Appendix) for future investment reflect not only the current strengths and ongoing efforts of the University, but also represent important priority areas as articulated by external sources. While funding from the NIH and NSF has become constrained, it continues to represent the primary source of support for academic research. The strategic areas identified above all align well with anticipated future NIH interest in translational research (as exemplified by NCATS), neurosciences, and cancer. These areas are also in alignment with the interests of less traditional federal funding sources, such as AHRQ, PCORI, MCHB, DARPA, and DOE.

Most importantly, the areas identified are clearly representative of new industry investments in the Commonwealth. The biotech sector in Massachusetts remains highly focused on rationally-designed drugs, biologics, and devices. These product streams are critically dependent on the above-mentioned focus areas. One timely example was the January 2014 announcement of the launch of Voyager Therapeutics, a neurosciences-oriented gene therapy company created by Third Rock Ventures by means of a major partnership with the UMass Medical School, in which the Medical School holds founder equity, receives sponsored research funding, licensing revenue, funded lectureships and internships. Numerous other recent examples and future opportunities exist where coordinated investments in the twenty-three focus areas could lead to new academic research funding from the commercial sector.

2.4 Reinvigorate the Commonwealth’s R&D Matching Grant Programs

The LSTF strongly recommends that the University engage with key stakeholders in state government to reinstate the Massachusetts Life Sciences Center’s Research Cooperative Matching Fund and to create a federal grant matching program for life sciences research, which would complement the state’s existing R&D Matching Fund.

Cost matching is often required to apply for large federal grants from sources such as the NSF Engineering Research Center or NIST Center of Excellence programs. Even if not required by the funding agency, cost matching may increase the competitiveness of proposals to certain programs, such as the NIH Clinical and Translational Science Award (CTSA), by leveraging agency dollars and demonstrating the strong endorsement of the host state(s) through a substantial commitment of resources. Moreover, a collaborative grant state matching fund can encourage industry-sponsored research collaborations.

In acknowledgement of the competitive advantage and incentives for industry-university collaboration provided by cost sharing, many states, including Massachusetts, have established R&D matching funds intended to fulfill some portion of a required match requirement, encourage collaboration or otherwise increase the competitiveness of a proposal. In 2012, a $50 million Research and Development Matching Fund was established by the Massachusetts Legislature. In 2010, the Massachusetts Life Sciences Center (MLSC) launched the Cooperative Research Matching Grant program

13 UMassMedNow Article, Voyager Therapeutics targets novel gene therapies to combat diseases:”
for the purpose of “increasing industry partnerships with in-state research institutions that will lead to the commercialization of translational research.” However, neither of these funds is currently available to support life sciences research. The state matching fund excludes life sciences-related projects and the MLSC has discontinued the Cooperative Research Matching Grant program.

The reinstatement of the MLSC’s Research Cooperative Matching Fund and the establishment of a federal grant-matching program for life sciences research would be extremely timely given the current budget climate and would competitively position the University’s grant proposals.

2.5 Establish a Support Fund to Facilitate Large-scale Grant Proposals

The LSTF recommends the creation of a dedicated fund to assist in the development of competitive center-level grant submissions.

Major state and internal investments in the life sciences have prepared UMass to compete aggressively for federal funding including and especially large-scale, multi-institutional awards, so-called “center-level” grants. Crafting competitive proposals for marquis agency programs such as the NIH Clinical and Translational Science Award (CTSA), NSF Science and Technology Center, NSF Engineering Research Center (ERC), NIST Center of Excellence, or the multi-agency (DOD, DOE, NIST, NSF) National Network for Manufacturing Innovation is a long-term, resource-intensive process. A review of winning teams from such competitions suggests that early planning, preparation and positioning—well before release of the public request for proposals—are critical for success.

Based on the previous experiences with successful center-level applications to NSF (Engineering Research Centers, Nanoscale Science and Engineering Centers) and NIH (CTSA), the University is cognizant of the level of effort, energy and coordination required, which may involve many months and hundreds of personnel hours. In an increasingly constrained funding environment, research excellence is a prerequisite. To win, teams must proactively lay a foundation for the award they seek and prepare a highly refined proposal that reflects intimate understanding of the funder’s objectives. While the President’s Science and Technology Initiatives Fund has helped somewhat to meet this increasing need

Therefore, the LSTF is proposing that a dedicated fund be made available through the UMass President’s Office to augment campus funds for the purposes of developing center-level strategies, securing partners, resourcing proposal team faculty or staff and engaging the assistance of professional proposal capture consulting firms who have extensive experience with center-level proposals and intimate knowledge of federal funding agency objectives. Use of funds may include:

- Faculty release time;
- Dedicated support staff; and
- Consultant fees for proposal capture, government relations or development of industry partnerships.

2.6 Establish System-wide Research Cores Coordinating Committee & Cores Capital Renewal Fund

The LSTF recommends the establishment of a System-wide research cores coordinating committee that would be charged with reviewing campus assets, setting research core priorities and promoting the efficient and effective use of existing research cores within the University and between the UMass System and industry partners. As a component of this initiative, the LSTF further recommends the
creation of a research core capital renewal fund, which would be overseen by the coordinating committee, to support the continued growth and impact of the University’s research enterprise.

Access to state-of-the-art research instrumentation and specialized facilities is a critical R&D resource for UMass researchers and industry partners. The cost of obtaining and maintaining expensive research equipment can be prohibitive for an individual research group. As an example, a new Transmission Electron Microscope costs approximately $1 million. Even if capital funds are obtained for the initial purchase, the annual operational costs associated with, for example, the maintenance and service contract and the personnel required to operate and manage the equipment may easily exceed $250,000 per year.

Many such high-end instruments have excess capacity by the group or campus that manages the research core. Making such instruments available to other faculty within the UMass system, researchers at other institutions, and industry R&D personnel through a research core structure has many benefits: (1) reduce duplication of purchase and support of similar instruments; (2) enable purchase of higher-end instruments and/or a broader spectrum of capabilities by pooling resources (e.g., instead of 3 identical instruments, one can be high temperature, another can be suited for more biological samples) ; (3) opportunities to assist and strengthen collaborations with other researchers, including industry; (4) reduction of subsidies required to maintain technical facilities; (5) enable more efficient deployment of technical staff.

There is increasing interest throughout the UMass System to establish additional research cores. While some cores may be able to achieve sustainability after a few years with an initial subsidy, others may provide an essential resource but need a long-term recurring subsidy. A key challenge to establishing and expanding research cores across the UMass System is the need for both capital funds for initial equipment purchase and for operating funds to establish an efficient, System-wide infrastructure.

The System-wide research cores coordinating committee, in conjunction with the research core capital renewal fund, would have an immediate and lasting impact of the University’s research infrastructure and activities. This fund will serve as a mechanism for researchers to request support for new or existing core facilities. Funding requests would be overseen by the System-wide coordinating committee that would evaluate, among other criteria, the breadth of the user base and the impact of the proposed capability. The System-wide research cores coordinating committee would also be charged with identifying strategies for increasing external access to and use of the University’s research cores and specialized equipment. By so doing, the University would be in a position to create new and strong linkages with Massachusetts companies and industry personnel, as well as augment support for operating the cores.

2.7 Strengthen System-wide Mechanisms that Promote Faculty Networks

The LSTF proposes the University strengthen mechanisms, such as the small conference grant program, that encourage inter-campus and inter-disciplinary collaborative efforts and that promote the continued development of strong faculty networks throughout the UMass System.

By offering mechanisms by which faculty members on different campuses and in different disciplines can come together for substantive discussions, the University will be promoting the creation of new, multidisciplinary teams to address pressing life science and health needs. This initiative would
support projects that are inter-campus in orientation and directed toward life sciences projects related to basic, translational, and clinical research. This fund would serve to spur inter-disciplinary collaboration and strengthen the University’s research portfolio in life sciences research by facilitating the development of faculty-to-faculty networks within the University System, thereby leveraging the considerable expertise and resources that exist on the individual campuses. It is assumed that successful conferences will serve as a springboard to attract additional funding from extramural sources.
V. Strategic Goal – External Engagement and State-wide Innovation

- Position the UMass campuses as hubs for industry engagement, technological innovation and regional development that drive the Commonwealth’s innovation ecosystem across all regions of the state.

**INTRODUCTION**

By virtue of its state-wide presence, public-oriented mission and technical expertise, UMass is uniquely positioned to anchor, drive and spur regional economic development and innovation. Indeed, during this previous five-year period, the UMass campuses have been instrumental in implementing the Commonwealth’s innovation strategy, most especially as it relates to the life sciences. The five-campus System now boasts a number of important resources for external stakeholders that, collectively, could be used as a strong foundation for launching a coordinated engagement strategy encompassing industry, private universities and independent research institutes. Some of these resources include:

- The UMass Innovation Institute (UMII)\(^\text{14}\) on the Amherst campus and soon-to-be adopted on the Lowell campus, which serves as a single point of entry for industry partners to ensure that University discoveries and technologies move forward into society;

- The Venture Development Center (VDC)\(^\text{15}\) on the Boston campus, which offers specialized facilities, business expertise and a supportive community to entrepreneurs so that they can launch their ideas into the market;

- The Massachusetts Accelerator for Biomanufacturing\(^\text{16}\) in Fall River, which, under the management and expertise of the University’s Medical School, will provide companies with a unique research facility with key capabilities for testing their biomanufacturing processes, training their current and future workforce and manufacturing their products at production scale;

- The Massachusetts Medical Device Development Center (M2D2) on the Lowell campus, which is a lifeline for the state’s smaller medical device companies, offering inventors and executives easy, affordable and coordinated access to world-class researchers and resources on the Lowell and Worcester campuses;

- The UMass Medicine Science Park on the Worcester campus, which is a leading center for biotechnology research and production, providing a nurturing environment for companies during all stages of growth;

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14 UMass Amherst Innovation Institute: [http://umii.umass.edu/](http://umii.umass.edu/)
16 Massachusetts Accelerator for Biomanufacturing: [http://www.southcoastlifesciencepark.com/UMD.html](http://www.southcoastlifesciencepark.com/UMD.html)
• The Massachusetts Technology Transfer Center\textsuperscript{17}, based at the System Office, which facilitates and accelerates collaboration and technology transfer between research institutions and Massachusetts companies; and

• The Massachusetts Green High Performance Computing Center\textsuperscript{18}, which is a data center dedicated to supporting the growing research computing needs of the five most research-intensive universities in Massachusetts—the UMass System, Boston University, Harvard University, MIT and Northeastern

As a result of these University resources, and many more, the UMass System has made important and impressive strides to solidify its position as an anchor for regional economic development. The LSTF believes the University has laid a strong foundation from which to accelerate these efforts. To contribute even more to the state’s innovation economy, broadly, and the life sciences sector, specifically, the LSTF strongly recommends a coordinated external strategy that creates linkages between the University and strategic partners throughout the Commonwealth.

To facilitate this strategy, the LSTF emphasized the importance of industry outreach to the success of the planning process. Members of the LSTF organized a number of industry visits and roundtables to learn more about their specific needs and perspectives and to open a channel for sustained engagement. These outreach efforts were focused on critical thematic areas for the life sciences. A listing of those areas and the companies involved in the LSTF process were:

• **Medical Devices** (organized by Mass Medic) – with Philips, Smith & Nephew, J&J, Medtronic;

• **R&D** (organized by MassBio and hosted by Vertex as part of President Caret’s bus tour) – with Vertex, Cubist, Genzyme, Novartis, Capsugel, J&J;

• **Talent** (sponsored by MassBio as part of their strategic planning) – with Genzyme, Parexel, Millennium/Takeda;

• **Entrepreneurship** – with Allied Minds, Hygeia Therapeutics, Launchpad Ventures, Mass Medical Angels;

• **Bio IT** – with Novartis, Clinical Future;

• **Health IT** – with Everyfit, Castling Group, Home Team Therapy, Reebok, RxApps, Smart Scheduling; and

• **Bio-manufacturing** – with AbbVie, Millipore, Organogenesis, Pfizer, Thermo Fisher, Merrimack Pharma

Given the feedback from external stakeholders, the LSTF recommends a series of objectives focused on developing System-wide and campus-specific capacity in industry engagement and commercialization, as well as promoting the value of partnering with the University. Implementation of these objectives, in concert with the other strategic objectives found in this report, will enable the

\textsuperscript{17} Mass Tech Transfer Center: \url{http://www.mattcenter.org/}

\textsuperscript{18} Mass Green High Performance Computing Center: \url{http://www.mghpcc.org/}
University to fully leverage its state-wide presence so as to position the five campuses as hubs for regional innovation and development. The purpose of such a strategy would be to help ensure that strategic investment, whether originating from or directed to UMass, benefits and positively impacts the life sciences ecosystem in all regions of the Commonwealth.

**STRATEGIC OBJECTIVES**

3.1 Create a Five-Campus Network of Life Science Regional Innovation Centers

The LSTF recommends that the University’s five campuses serve as a network of life sciences regional innovation centers that promote innovation and the growth of the life sciences industry throughout the Commonwealth by strengthening the University’s capacity for effectively, efficiently and reliably engaging with key state-wide and regional partners.

The Commonwealth’s Life Sciences Initiative calls for the development of regional life sciences innovation centers that would provide infrastructure and services to promote and support growth of the life sciences super-cluster in Massachusetts, including but not limited to medical devices, advanced manufacturing, drug development and bio-manufacturing. It was envisioned that these centers would support technology commercialization, innovative new product development, business incubation and acceleration, as well as workforce development activities. The intent of such centers is to promote innovation and the growth of the life sciences industry, not only in the greater Boston region, but throughout the Commonwealth. Given their geographic distribution throughout the State, the UMass campuses are perfectly positioned to serve as regional life sciences innovation centers. However, in order to emerge as a state-wide hub for regional innovation, the University System must first create the internal conditions that will distinguish the institution as an effective, efficient, reliable and enthusiastic partner.

**System-wide Capacity:**

Key characteristics of life sciences regional innovation centers would include responsiveness to clearly identified industry needs and interests; strong university-industry links; a focus on translational research and commercial applications; shared facilities, equipment, services and incubators; attention to workforce development; a robust internship and co-op program that offers students with meaningful experiential learning opportunities; support from local governments and the life sciences community; and external support for capital and operating funds.

Many potential industry partners perceive UMass as truly a System, rather than a collection of five independent campuses. Therefore, companies are often frustrated when they learn that there is no single access point at the University. To address this issue, the LSTF recommends that the System create a single point of entry mechanism to that would provide “one stop shopping” for interested external partners. A single portal will facilitate connections to research expertise on each campus and provide a streamlined mechanism to complete research agreements. This approach would expedite agreements, increase campus research funding and be much less confusing to interested partners. To this end, the System may consider re-instituting a coordinator position for industry relations that can work with key campus liaisons to coordinate and strengthen the University’s external engagement activities.
The Office of General Counsel has proven very effective at developing “master agreements” with Industry and Federal Agencies, (e.g., the system-wide CRADA with the U.S. Army Natick). There is now an opportunity to attempt such a master agreement on a large scale with what is often described as the largest cluster of biotechnology R&D in the world. Each campus and the General Counsel’s Office could designate a point of contact for industry-research relations. The LSTF envisions that a portal for interested external partners could streamline and encourage UMass-industry interactions for long-term, strategic partnerships and will be a strategic advantage to promote additional external engagement.

Campus Capacity:

Any System-wide model that promotes the regional innovation concept will only be realized if sufficient resources exist to build and sustain a robust campus capacity for industry engagement. Recent investments and structural changes are underway at some campuses and reflect positive momentum regarding this issue. For instance, the UMass Innovation Institute has been an unqualified success over its first 24 months at UMass Amherst (25% growth in overall industry R&D) and this model is now being adopted at UMass Lowell. Several successful technology centers/incubators have recently launched, such as the Massachusetts Medical Device Development Center, the Venture Development Center and the Center for Personalized Cancer Therapy. A new technology center based in Fall River, the Massachusetts Accelerator for Bio-manufacturing, will be opening in the near future, adding another resource to the University’s expanding portfolio of strategic capabilities. In addition, efforts are underway to hire an Executive Vice Chancellor for Business Development at the Medical School, who will be responsible for fostering business development, industry engagement and commercialization on behalf of the Worcester campus, which has the largest life sciences research portfolio within the UMass System. Each of these examples represents a substantial investment by the campuses to change and enhance the way in which the University interacts and engages with external partners. While these are exciting developments, they reflect only some of the investments that are required to continue this positive trajectory over the next five to seven years.
3.2 Launch a Coordinated Public Information and Outreach Initiative that Communicates and Accelerates the University’s Impact on the Commonwealth’s Innovation Economy

The LSTF recommends a public information and outreach initiative to inform key stakeholders about the scope and impact of the University’s research, development and commercialization endeavors. This initiative would have two-pronged approach: one that would be focused on increasing awareness among external partners in the state and one that would be focused on conveying the positive impacts of research to policy makers and the public at large.

With respect to the first component, the University has found that there is little awareness of UMass and its life sciences activities and collaborations among Massachusetts companies. In cases where industry has worked closely with UMass, or in very specific research areas (e.g., polymers, nanomanufacturing, biology) the University’s reputation is synonymous with excellence. However, its reputation for readiness to conduct business with industry or for being an innovative institution could be stronger, and it does not have a major R&D presence in the geographic center of the life sciences cluster (e.g., Boston-Cambridge). To address this, the University should consider having a physical presence with appropriate staff in the Kendall Square area.

For these reasons, the LSTF proposes a five-year public information and outreach initiative to improve the University’s level of awareness and reputation among industry and to develop outreach...
actions that create and grow robust industry partnerships focused on medical devices, pharmaceuticals, biologics, biomarkers/diagnostics, novel drug delivery methodologies, informatics (health IT and bioinformatics), and biomanufacturing.

This plan should include:

- Development of a systematic approach to industry engagement, building on programs such as the UMass Innovation Institute (piloted on the Amherst campus and soon to be extended to the Lowell campus), M2D2 in Lowell, the UMass Dartmouth Advanced Technology Manufacturing Center (ATMC), and the UMass Boston Venture Development Center (VDC);

- Regular engagement with companies and industry advisory groups, including MassMEDIC, MassBIO and others (e.g., the Bio-Manufacturing Roundtable) and establishing a stronger UMass presence in the Boston-Cambridge innovation area. A key element is senior, executive-level relationship building. For instance, the University should have seats on the boards of MassMedic and MassBIO and have faculty and staff actively engaged on their committees. In addition, UMass should have representatives of the life sciences industry on its Board of Trustees (there are currently zero) and should consider the creation of an advisory council comprised of key executives representing the Commonwealth’s life sciences community that would work with the Senior Vice President for the Health Sciences to identify strategies to promote and sustain UMass-Industry engagement;

- Establishment of an organizational capability for sophisticated industry relations, including a “portal” at each campus responsible for industry relations that not only manages incoming calls but also scouts future R&D interactions and demonstrations, pilot proposals, and conduct targeted email and phone interactions; and

- Promotion of UMass capabilities with targeted organizations, exhibiting important investigators and their work via increased speaking opportunities and involvement in regional economic development organizations.

With respect to the second component of this effort and to address the current environment around federal funding of research, the University will need to become increasingly adept at educating the public and policymakers about the profound economic, societal and health benefits associated with life sciences research. With this as context, the LSTF recommends a comprehensive communications program called the “Validating Science Initiative.”

While some work has been done on scientific communication and methods to measure scientific impact, much of these fields are underdeveloped and could greatly benefit from rigorous hypothesis-based research. The Validating Science Initiative (VSI) would conduct research and develop new metrics to:

- Establish the economic value of UMass scientific output;
- Establish the societal impact of UMass scientific output; and
- Enhance awareness of and engagement in the UMass research portfolio.
Through the VSI, the University would develop a network model for internal/external communications and scientific programs. Investigators will learn to effectively convey the pivotal role of investments in basic science that lead to breakthrough discoveries that, in turn, enable translational innovation and the implementation of interventions that tangibly improve human/animal/environmental health. Integration of this program into educational and training programs will be important to ensure sustainability of funding for the next generations of scientists.

3.3 Enhance and Expand Campus-based Entrepreneurship and Commercialization Activities

The LSTF recommends a targeted and more robust approach to entrepreneurship and commercialization on the campuses.

Based on focus groups and industry input, members of the life sciences community recognize the high quality basic research being undertaken at UMass. However, there is a general belief that the UMass campuses lack the resources, programs and expertise to commercialize UMass discoveries. With additional support and a concerted effort to change the internal culture and address infrastructure challenges, the University would be positioned to more effectively commercialize its research portfolio, leading to a greater impact.

Consequently, the LSTF suggests the following targeted initiatives:

A. There is a major gap in the funding available for proof of concept work. Currently awards are available at $5,000 for marketing and $25,000 for technology development, and there is investment funding up to $500,000 once the company has been spun-out. But there is a need for more robust proof of concept funding that can support technology development in the $100,000 to $150,000 range. Such funding is envisioned in House Bill 1082 currently under consideration in the Legislature. The legislation would provide $8 million in proof of concept funding, with at least half being reserved for UMass, to be administered by the Massachusetts Technology Transfer Center.

B. UMass would benefit from a more robust and comprehensive internal structure for supporting researchers who want to spin-off companies. This should include the establishment of a system of “Innovation Agents” that will work with campus leadership and the UMCCTS to identify and foster innovation and entrepreneurship opportunities through incubators, mentorship, business and regulatory development support and seed funding. These Innovation Agents will take advantage of existing infrastructure and resources, such as the Massachusetts Technology Transfer Center, UMass Boston’s Venture Development Center, UMass Amherst’s Innovation Institute and Institute for Applied Life Sciences, UMass Medical School’s MassBiologics and MassTERi and UMass Lowell’s Medical Device and Development Center. To work in concert with these Innovation Agents, there should be a mechanism to bring in more expert mentors to work with researchers and help them understand the market and business requirements of setting up a new company. This effort should focus initially on the recruitment of alumni who have the expertise and interest in working with the campuses. Finally, there needs to be stronger education/accelerator programs that will support the researchers, helping them understand the start-up process and to maintain momentum.
C. UMass should find ways to support spin-off companies as they raise their initial rounds of funding. Recently, the UMass Board of Trustees has authorized, under certain circumstances, the investment of up to $500,000 of University funds to support start-up companies based on the University’s intellectual property. This is a positive step, and the University should continue to find ways in which to spur the development of spin-off companies. One additional possibility may be the establishment of a Crowd Funding mechanism whereby spin-off companies could raise funds from interested UMass Alums.

Some successes in this area are beginning to emerge. For instance, through the third quarter of FY 2014 the University has been involved in six new start-ups (including the high profile launch of Voyager Therapeutics) which is the largest number of start-ups created in one year in the University’s history. Similarly, the first-ever System-wide task force on entrepreneurship was recently created by CVIP and MTTC. The task force has developed the concept of “The UMass Entrepreneurship Commons” that connects, supports, supplements and promotes exciting and new entrepreneurial programs across the UMass System.

3.4 Creation of a Life Sciences Investment Fund to Support Innovative and Multi-campus Research Initiatives

Over the course of the last five years, the University has made significant strides in building an ecosystem that supports the full breadth and depth of the System’s research enterprise and fuels regional innovation. One factor contributing to this success is the University’s strategic and targeted investment of innovative research facilities and initiatives that leverage existing and complementary expertise found across the University System for the benefit of the state-wide life sciences community.

Life sciences research is a capital- and labor-intensive activity, and the infrastructure necessary to support a burgeoning and impactful research enterprise requires sustained investment. The University System and the individual campuses, during the previous five-year period, have directed substantial amounts of capital funding in support of research facilities and initiatives. Taken together, the collective capital investment has supported the construction of a number of signature facilities, which already are transforming the University’s research enterprise for the benefit of the broader life sciences ecosystem in the state. Examples can be found on each campus: on the Amherst campus, it is the Institute for Applied Life Sciences; on the Boston campus, the Integrated Sciences Building; on the Dartmouth campus, the Massachusetts Accelerator for Bio-manufacturing; on the Lowell campus, the Emerging Technologies and Innovation Center; and on the Worcester campus, the Albert Sherman Center.

In order to build on the successes emanating from this System-wide program of capital investment, the LSTF recommends the creation of a Life Sciences Investment Fund to support innovative research projects, with an emphasis on multi-campus initiatives. The Investment Fund would be a competitive grant program overseen by the System Office in close coordination with the campuses. This dedicated pool of capital funding would support new and emergent research initiatives that cultivate linkages between the campuses, enhance the System’s life sciences education and research portfolios and strengthen the University’s impact across Massachusetts. Given the state-wide impact created by Investment Fund-supported projects, the University would encourage matching support from public and private entities to realize the full extent of the System’s research initiatives.

Research initiatives that meet the above criteria and show promise of qualitatively impacting the University’s research enterprise and life sciences ecosystem include the following projects.
A. Small Molecule Screening Facility (MassTERI & IALS)

Access to screening facilities is critical to the development of novel small molecule drugs. At present, the only small molecule screening facility available to the UMass community is a small, outdated facility at the medical school campus. New equipment and small molecule libraries, as well as additional staff are needed to update this facility. Increased access to state-of-the-art small molecule screening, along with robust entrepreneurship and commercialization support, could significantly enhance the number of drugs developed from UMass discoveries, which in turn, could lead to increased licensing revenues for the System and economic development from spinoff companies.

B. M2D2 Expansion

The M2D2 Center, housed in the Wannalancit Mill in Lowell, has been an overwhelming success. Founded in 2008, it has leveraged about $5 million in State and University funds to assist 100 medical device companies in raising over $24 million in private investment funds and $5 million in grants. Lowell incubator space is currently at capacity and there is an interest in expanding medical device incubator space/services in Lowell and in developing new capacity at the Worcester and Amherst campuses.

Advanced manufacturers, particularly concentrated in the Western part of the Commonwealth, are interested in partnering with fledging companies that are preparing to scale up production of their new medical device products. Augmenting the development of UMass devices for use in the clinic specifically addresses the UMCCTS priority goal of developing products that improve human health. Product licensing or company spinoffs would contribute to increased UMass System revenues and economic development through job creation.

C. Center for Robot-Assisted Home and Rehabilitation Care

Robot-assisted living and therapy represents a rapidly growing field due to the increase in numbers of aging adults who wish to remain in their homes longer and of people with physical and/or cognitive disabilities. A key challenge remains in improving human-robot interaction in everyday environments. Leveraging the recently-opened New England Robotics Validation and Experimentation (NERVE) Center, researchers would have access to mock-ups of home settings as well as environments that will be used to emulate community settings. These environments will be utilized to test, for instance, the use of lower limb robotic systems in different ambulatory conditions, such as level-ground walking, stair ambulation, and different types of terrain (e.g. tile, cobblestones, carpet), or for assessing coupled human-robot motion in support of daily activities.

The facility would benefit researchers across the System in complementary areas, including but not limited to: robotics, machine learning and natural language processing, wireless health sensing, physical therapy and kinesiology gerontology and disability studies. Many of the more than 80 robotics companies in the region (employing 2500 people and generating roughly $1B in sales) would also benefit from access to the facility and to the UMass expertise brought together in this Center.

D. Center for Multi-modal Biomedical Imaging (CMBI)

Significant advances have been made in individual imaging technologies, but there is even greater promise in coupling multiple methods to achieve coordinated spatial-temporal imaging. For example,
such multi-modality may offer the combined functional imaging of PET, the spectroscopic capabilities of terahertz imaging, and the superior cell resolution imaging of optical, to better understand dynamically the measurement and tracking of biomarkers and imaging agents.

The CMBI would leverage System-wide expertise in engineering of imaging systems and medical research. The CMBI is envisioned as a research center where a number of versatile multimodality pre-clinical imaging platforms will be available, providing small animal PET, SPECT, CT, MRI, optical, and terahertz imaging and analysis. Combinations of the individual units will be docked into a single platform. This research workplace will permit researchers to study technical challenges such as: signal interference, unified data acquisition and post processing, and cross-modality image review, fusion, and analysis.

Such multi-modal imaging capability would bring together UMass researchers working on imaging controls, metrology, and signal processing for the benefit of life science researchers across the System working on areas such as pharmacokinetics, imaging agents, diagnostics, and cancer research. For example, ongoing collaborations in breast cancer research colorectal cancer, skin cancer and brain tumors are showing promise for innovative multi-modal imaging techniques.

E. Center for Microbiome Research

Humans have co-evolved with their microbiome to exist in a symbiotic relationship, where the diversity of the microbiome plays an essential role in protective, metabolic, and structural functions that keep them healthy. In a way, the gut microbiome may be thought of as a newly discovered “organ” whose presence was not generally recognized until the late 1990s, but has a potentially enormous impact on human health. Indeed, many emerging studies have linked the status and composition of the microbiome to diseases including diabetes, liver diseases, rheumatoid arthritis, muscular dystrophy, multiple sclerosis, fibromyalgia, and even some cancers. Experiments also suggest that the microbiome plays a critical role in the development of inflammatory bowel disease, and that obesity might even be related to a low diversity of microbes in the gut. Since some of the microbes in our body can modify the production of neurotransmitters, microbiome research may also provide a pathway to therapies for schizophrenia, depression, bipolar disorder and other neuro-chemical imbalances.

The goals of the center would be to: keep pace with the brisk pace of discoveries and position UMass as a leader in Microbiome Research; provide the expertise and infrastructure required for all aspects of microbiome research including patient studies, bioinformatics analysis, ecological studies or genomics; facilitate collaborative, innovative studies at the macroorganism - microbiome interface that will unify the "microbiome" of the University of Massachusetts; and provide funding opportunities for the University System.
VI. Implementation and Evaluation Plan

❖ REALIZING THE UNIVERSITY’S LIFE SCIENCES VISION: THE LSTF’S IMPLEMENTATION AND EVALUATION PLAN

This report articulates and defines a clear strategic direction in the life sciences for the University of Massachusetts over the next several years. Given the composition of the LSTF, which included key stakeholders from the five campuses and President’s Office, the goals and objectives outlined herein represent the collective vision of the UMass System. Such a coordinated vision, taken alone, is a major step forward for the University of Massachusetts for it recognizes that the System is greater than the sum of its component parts. This is a critically important development, if not a fundamental paradigm shift, and bodes well for the University’s future prospects in an increasingly competitive research environment.

In order to advance to this point—and construct a truly System-oriented vision—the LSTF consciously prioritized the development of strategic goals and objectives over the creation of operational plans, implementation strategies and measures of success. Enacting the vision will be the second phase of the LSTF process. Upon final endorsement of this plan, the LSTF will be reconstituted in the 2014 – 2015 Academic Year to focus on a comprehensive implementation plan that will ensure the vision presented herein is realized. The LSTF implementation team should be charged with the following activities:

- Creating an appropriate process that will support a multi-year implementation plan;
- Coordinating the creation of a number of new committee-like structures as recommended in the plan, such as:
  - UMass-Industry Working Groups focused on academic degree programs and internship/co-op opportunities;
  - Undergraduate STEM Student Success Strategy Working Group;
  - UMass Industry Relations Working Group;
  - The Senior Vice President for Health Sciences Life Sciences Advisory Council;
  - System-wide Research Cores Coordinating Committee;
  - “Commonwealth Fellows” and “Presidential Scholars” Working Groups;
  - Life Sciences Investment Fund Coordinating Committee; and
  - “Innovation Agents” Working Group.
- Prioritizing the strategic objectives that will be implemented in the first year;
- Defining the specific milestones and measures of success for each year of the implementation plan; and
- Setting the budgetary targets associated with the strategic objectives and identifying the necessary resources to achieve those objectives.

A similar implementation approach was adopted by the team responsible for fulfilling the goals of the initial life sciences strategic plan. That implementation process was highly successful in creating and fulfilling the ambitious initiatives articulated in the 2008 plan. Such a record of success bodes well
for the forthcoming implementation process as the LSTF team will benefit from that example, which demonstrated the University’s effectiveness in coming together to execute on a strategic vision.
VII. Conclusion

The three overarching strategic goals identified in this plan: 1) developing life sciences talent across the pipeline; 2) fostering an innovative, complementary and impact research enterprise; and 3) positioning the University as a state-wide hub for regional innovation and industry engagement, are founded upon a clear recognition that the University of Massachusetts, as the state’s premier public research university, has a special responsibility to leverage its state-wide presence and diverse expertise for the benefit of the Commonwealth and its geographic regions. Moreover, the strategic direction as articulated in this plan, which calls for greater cohesion, collaboration and coordination among the UMass System and between the System and external partners, is based on a shared understanding that the University must function in a more effective, efficient and entrepreneurial manner in order to meet the challenges and take advantage of the opportunities attendant to the broader environment in which the UMass System operates.

The University of Massachusetts remains wholeheartedly committed to serving as the primary partner of and resource for the Commonwealth’s life sciences community. To continue to do so in the years ahead, the UMass System must offer a compelling vision and unmatched value proposition to the key stakeholders of the life sciences community, including state government, state agencies like the Massachusetts Life Sciences Center, industry, research institutes and other entities within the higher education sector.

The UMass Life Sciences Task Force endeavored to offer that vision and articulate that value proposition through the development of this University-wide life sciences strategic plan. The strategic goals and objectives outlined in the document were developed within a framework of shared investment, strategic alignment and mutual benefit, as well as founded upon a clear recognition that the continued success of the University’s life sciences enterprise will be dependent upon and inextricably linked to the continued success of the Massachusetts life sciences community.

As the initial strategic planning process powerfully demonstrated, it is critically important, both for the University and the Commonwealth, to align priorities and strategies between the state’s public research university, state government and other key constituencies. This new strategic plan builds on that theme as it includes a series of University-driven initiatives, investments and internal improvements that are aligned with and complement the Commonwealth’s strategic priorities and future direction in the life sciences. In this model of shared and strategic partnership, the University’s life sciences investments can be fully leveraged through targeted support from key external partners, thereby maximizing the benefit to and impact on the broader life sciences ecosystem in Massachusetts.
### VIII. Appendix

#### A. UMass Life Sciences Task Force Membership

| UMass LSTF Chair | Michael F. Collins, M.D.  
Senior Vice President for the Health Sciences, University of Massachusetts  
Chancellor, UMass Worcester |
|-------------------|---------------------------------------------------------------------|
| UMass LSTF Staff  | Brendan H. Chisholm  
Chief of Staff – Chancellor’s Office, UMass Worcester  
Nate Hafer, PhD  
Director of Operations, UMass Center for Clinical and Translational Sciences |
| UMass Amherst     | Marjorie Aelion, PhD  
Dean, School of Public Health and Health Sciences  
Timothy J Anderson  
Dean, College of Engineering  
Distinguished Professor of Chemical Engineering  
James Capistran, PhD  
Executive Director, UMass Innovation Institute  
Steven D. Goodwin, Ph.D.  
Dean and Professor, College of Natural Sciences  
Michael F. Malone, Ph.D.  
Vice Chancellor for Research and Engagement  
Ronnie and Eugene M. Isenberg Distinguished Professor of Engineering  
Loren Walker  
Director, Research Development  
Annette B. Wysocki, BSN, MSN, PhD  
Associate Dean and Professor, College of Nursing |
| UMass Boston      | John Ciccarelli  
Associate Vice Chancellor for Government Relations, Public Affairs, and Economic Development  
Adán Colón-Carmona, PhD  
Associate Professor of Biology – Cell Biology, Genetics and Molecular Biology of Plants  
Andrew J. Grosovsky, ScD  
Dean, College of Science and Mathematics  
Professor of Mechanisms of Mutagenesis and Genomic Instability in Human Cells  
Laura L. Hayman, PhD, RN, FAAN, FAHA  
Associate Dean for Research, College of Nursing  
Associate Vice Provost for Research  
Anahid Kulwicki, PhD, RN, FAAN  
Dean & Professor, College of Nursing and Health Sciences  
Jill A. Macoska, PhD |
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<td>UMass Dartmouth</td>
<td>Erin Bromage, PhD</td>
<td>Associate Professor of Biology</td>
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<td>Catherine C. Neto, PhD</td>
<td>Professor of Chemistry and Biochemistry</td>
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<td>James A. Fain, PhD, RN, BC-ADM, FAAN</td>
<td>Dean and Professor of Nursing</td>
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<td>Louis Goodman, PhD</td>
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<td>Paul Vigeant, MPA</td>
<td>Assistant Chancellor for Economic Development</td>
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<td>UMass Lowell</td>
<td>Susan Braunhut, PhD</td>
<td>Professor of Biological Sciences</td>
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<td>Julie Chen, PhD</td>
<td>Vice Provost for Research, Professor and Co-Director for Mechanical Engineering</td>
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<td>Mark Hines, PhD</td>
<td>Acting Dean, College of Sciences, Professor of Biological Sciences</td>
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<td>Steve McCarthy, PhD</td>
<td>Director and Professor of M2D2 and Plastics Engineering</td>
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<td>Mingdi Yan, PhD</td>
<td>Professor of Organic/Materials Chemistry</td>
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<td>UMass Worcester</td>
<td>Terence R. Flotte, M.D.</td>
<td>Executive Deputy Chancellor, Provost, Chief Research Officer, &amp; Dean, School of Medicine</td>
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<td>Catarina Kiefe, MD, PhD</td>
<td>Chair and Professor of Quantitative Health Sciences</td>
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<td>Mark Klempner, MD</td>
<td>Executive Vice Chancellor, MassBiologics of UMMSS</td>
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<td>Katherine Luzuriaga, MD</td>
<td>Professor of Molecular Medicine, Pediatrics, and Medicine, Director, UMass Center for Clinical and Translational Science, Vice Provost, Clinical and Translational Research</td>
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<td>Gyongyi Szabo, MD, PhD</td>
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B. LSTF Process and Work Plan

The LSTF planning process commenced in the spring of 2013 following the endorsement of the campus chancellors and the formal approval of President Caret. Chancellor Collins requested that each campus provide the names of its representatives to the LSTF and that each chancellor select one of those campus representatives to serve on the LSTF Stewardship Group.

The Stewardship Group initially convened in April 2013 to develop an appropriate planning process, establish a prudent project scope and set a sensible timetable for completion of the LSTF’s work. Subsequently, the LSTF held its first formal meeting in May 2013. During this kick-off meeting, Chancellor Collins provided a comprehensive summary of the first life sciences planning effort so that colleagues new to the University and the LSTF would have a solid understanding of the context for and accomplishments associated with the 2008 plan. Chancellor Collins further discussed the preliminary plan for the new planning process and then oversaw a healthy and substantive discussion on thematic areas.

At that initial meeting, the membership decided, for the purposes of the planning process, it would be best to organize the LSTF’s efforts into six working groups focused on the following thematic areas: 1) Talent; 2) External Support and Engagement; 3) Discovery Research; 4) Research Across the Translational Spectrum; 5) Inter-campus Collaboration; and 6) Industry Engagement and Entrepreneurship. The working groups were quickly populated and work plans were developed.

Each of the working groups was asked to complete an initial situational analysis of its specific thematic area prior to the second full meeting of the LSTF in June 2013. The working groups presented their initial findings in June and were encouraged to continue to work over the summer months to discuss and identify objectives, needs, goals, and methodologies.

At the third meeting of the LSTF in September 2013, the working groups discussed the major themes/needs that emerged over the summer. They were subsequently asked to develop the “big asks”/recommendations that would perhaps appear in the LSTF report.

The LSTF membership also developed a plan to ensure engagement with each of the five campuses and important external constituencies. An important improvement over the initial planning process was the engagement of industry stakeholders. Having their feedback resulted in a more complete and comprehensive series of recommendations. The companies and organizations engaged during the LSTF process are listed below.

- Medical Devices (organized by MassMedic) – with Philips, Smith & Nephew, J&J, Medtronic
- R&D (organized by MassBio and hosted by Vertex as part of President Caret’s bus tour) – Vertex, Cubist, Genzyme, Novartis, Capsugel, J&J
- Talent (sponsored by MassBio as part of their strategic planning) – with Genzyme, Parexel, Millennium/Takeda
- Entrepreneurship – Allied Minds, Hygeia Therapeutics, Launchpad Ventures, Mass Medical Angels
- Bio IT – Novartis, Clinical Future
- Health IT – Everyfit, Castling Group, Home Team Therapy, Reebok, RxApps, Smart Scheduling
Bio-manufacturing – AbbVie, Millipore, Organogenesis, Pfizer, Thermo Fisher, Merrimack Pharma

As part of the campus engagement process, each of the working groups drafted a vision statement, as well as a series of strategic questions to be addressed during the campus engagement process.

Key Strategic Questions:

Talent:

1. What are the broader trends within the life sciences talent development field?
   a. Local
   b. National
   c. International
2. What are the most relevant models for the following?
   a. Inter-campus collaboration
   b. Strategic partnerships with public and private institutions from different sectors

Discovery Research:

1. What level of growth in research do we anticipate over the next 5 years?
2. What strategic directions will enhance research growth?
3. Where are the alternative funding sources beyond NIH/NSF?
   a. Industry
   b. Philanthropy
   c. Other governmental agencies such as AHRQ, PCORI, DARPA
4. What are our capital vs. operational funding needs?
5. Specifically, what is the growth potential within recently added facilities?
6. What other non-monetary outcome measures should be monitored in the life sciences?
   a. Quantitative beyond grant funding such as publications, new ventures, collaborative and center grants, reputation and so on.
   b. Qualitative such as stories describing the impact of basic research on translational research, STEM education and so on.

Research Across the Translational Spectrum:

1) What life science topic areas are ripe for expansion across UMass?
2) What are the most helpful research platforms/support systems to accelerate translational research?
3) What are the best ways to get people together to work on translational research projects? In particular, how can we get basic and translational scientists working together?

External Support and Engagement:

1. Are there external stakeholder groups beyond those above that you feel should be included?
2. Did your campus find the funds awarded in the last $1 B life sciences legislation through the Mass Life Sciences Center were beneficial to the campus and that they advanced life sciences? If not, what could have been better?

3. If you had some state funding, what are three things your campus would spend money on to increase its impact on life sciences fields in the Commonwealth?

**Inter-campus Collaboration:**

F. What are the top barriers to establishing collaborations across campuses (e.g., finding collaborators, seed funding, navigating mechanisms to jointly sponsor students, ability to spend time at another campus as a visiting researcher/affiliated faculty)?

G. If you were looking for a collaborator, what kind of web-based information would be most helpful (e.g., searchable research interests, list of publications, interest in collaborating)?

H. What would be a key factor to your use of core research facilities on another campus?

I. There are collaborative seed funding programs such as the Life Sciences Moment Fund and the Next Hundred Million program that provide funding levels appropriate for preliminary research. We are looking to foster additional collaborations by also providing multiple moderate seed grants (e.g., $30K). The CCTS already hosts themed workshops at its annual conference as a way to encourage collaborations. Would it be effective to provide moderate funds to groups based on outcomes of these workshops (e.g., to fund a plan that includes staff time for project management and/or proposal writing, or for outreach)?

**Industry Engagement and Entrepreneurship:**

1. What are the current models of industry engagement and how can they be improved at the campus level?

2. What are the current models for promoting start-ups based on university IP and how can they be improved at the campus level?

3. What additional steps can be taken at the System level to enhance industry engagement and entrepreneurship, e.g., awareness and marketing to industry, master agreements, financial incentives, staffing, and formal survey of industry needs (e.g., updated talent study)?

To publicize these town hall sessions and to promote broad involvement from each of the campuses, Chancellor Collins made a video that provided the context for the LSTF planning effort, the link of which is found here: [http://youtu.be/1W1okbvGweA](http://youtu.be/1W1okbvGweA). Town hall sessions to provide input into the planning process were held on each campus during the fall of 2013, and the schedule is included below.

<table>
<thead>
<tr>
<th>Campus</th>
<th>Date</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amherst</td>
<td>Tuesday, October 8</td>
<td>3 – 5 pm</td>
<td>Student Union Ballroom</td>
</tr>
<tr>
<td>Boston</td>
<td>Thursday, October 10</td>
<td>3 – 5 pm</td>
<td>Venture Development Center</td>
</tr>
<tr>
<td>Dartmouth</td>
<td>Thursday, October 3</td>
<td>1 – 3 pm</td>
<td>Library -Grand Reading Room</td>
</tr>
<tr>
<td>Lowell</td>
<td>Tuesday, October 1</td>
<td>3:30 – 5 pm</td>
<td>Southwick, Room 240</td>
</tr>
<tr>
<td>Worcester</td>
<td>Thursday, September 26</td>
<td>9 – 10 am</td>
<td>Lazare Research Building, Room 203</td>
</tr>
</tbody>
</table>
The fourth LSTF meeting in October provided an opportunity for the campus representatives to the LSTF to offer a summary of their respective town hall meetings. During this session, it became clear that common themes were emerging from the campus town hall meetings and across the different working groups. Given this, each group was asked to refine its list of major needs and to develop a preliminary estimate of the resources required. Moreover, and to ensure that the process continued to move forward, the LSTF was presented with an outline of the final report and encouraged to start drafting text for their sections in the report.

The November meeting of the LSTF primarily focused on the “big asks and recommendations” developed by the working groups. The membership discussed and debated the merits of the asks brought forward in order to build consensus around the major themes and recommendations that would serve as the basis for the final report.

The LSTF convened for a sixth meeting in December. At this meeting, Chancellor Collins informed the membership that he briefed the President and his fellow chancellor colleagues on the work of the LSTF and presented them with an initial listing of the working groups’ recommendations. Furthermore, he provided a summary of his meetings with the Massachusetts Biotechnology Council and MassMEDIC. These meetings were part of a broader engagement process that focused on key external constituencies that could help to inform the planning process, particularly the University’s strategies for engaging with industry. Chancellor Collins found that both organizations were quite appreciative for the engagement, and they conveyed a willingness to continue to work with UMass during and after the conclusion of the LSTF process. There was a great deal of enthusiasm for the LSTF’s proposed vision, especially with respect to workforce issues and industry engagement opportunities. Following these presentations, the President’s Office received a number of calls inquiring about internship opportunities and follow-up activities.

The December meeting also focused on the final asks emanating from the working groups, as well as the University’s research cores.

With the final recommendations from the working groups submitted, the LSTF Stewardship Group convened soon after the December meeting to organize the recommendations around key thematic areas:

1) Faculty development;
2) Academic enrichment opportunities/workforce development;
3) Research funding opportunities;
4) Statewide economic development and industry engagement;
5) Capital for research equipment, cores and facilities;
6) Selling and telling the UMass Life Sciences story; and
7) Inter-campus collaboration.

Moreover, the Stewardship Group assigned each of the recommendations to a particular working group, and asked the working groups to further develop their assigned recommendations, with special attention given to the recommendations’ rationale, budget and potential funding sources. Using a common template to ensure consistency, the working groups submitted one-page summaries of their assigned recommendations to the Stewardship Group on January 22nd.
On January 28th, the Stewardship Group convened via a conference call to review the recommendations and to reach consensus on next steps. In order to better organize and prioritize the many recommendations, the Stewardship Group made a decision to further refine the thematic areas to the following:

1) Life sciences talent development through the life cycle;
2) The five campus network as regional hubs for the life sciences;
3) Strategic life science programmatic and capital investment; and
4) Strategies for enhancing collaboration in the life sciences across the University System and with external partners.

Given how the planning process evolved—from a working group approach to a theme-based approach—the Stewardship Group determined that the contributions of the working groups, including their content-specific recommendations, would be incorporated in and subsumed by the emergent thematic areas. Beginning with the special meeting of the Stewardship Group on February 4th, the recommendations that initially were linked to a specific working group would, moving forward, be aligned with a particular thematic area.

Subsequent to the February 4th Stewardship Group meeting, a final contraction of the thematic areas occurred, resulting in three overarching themes that serve as the foundation for the work of the LSTF. The three themes that ultimately surfaced were:

1) **Developing talent across the pipeline**—through targeted initiatives that span the talent pipeline, from undergraduate educational enrichment strategies to faculty development programs, promote the University’s central role in strengthening the Commonwealth’s global leadership position in the life sciences.

2) **Fostering an innovative, inter-connected and impactful research enterprise**—create the conditions, support the enabling platforms and invest in the key strategic priority areas that will enhance the breadth, depth, scope and diversification of the University’s R&D efforts.

3) **Positioning the UMass campuses as hubs for regional innovation**—implement a number of internal strategies that leverages the University’s state-wide presence and expertise to enhance the quality and number of external partnerships and engagements and to drive regional economic development and innovation.

The recommendations that originated with the Talent Working Group now served as the basis for the thematic area related to developing talent across the pipeline. The recommendations put forward by the Discovery Research and Research Across the Translational Spectrum Working Groups were directed to the theme of fostering an innovative, inter-connected and impactful research enterprise. Contributions from the External Support and Engagement and Industry Engagement and Entrepreneurship Working Groups helped to shape the theme of positioning the UMass campuses as hubs for regional innovation. Finally, the ideas generated by the Inter-campus Collaboration Working Group transcended any one thematic area and, in fact, tied together all three.

Using the three overarching themes as the basis for the final report, LSTF staff set about drafting an initial first draft in March. During a conference call on March 21st with the Stewardship Group,
Chancellor Collins solicited the Stewardship Group’s feedback, and requested that the group help to fill in missing gaps and strengthen certain sections.

Following a further revision, the draft report was forwarded to the LSTF membership and the campus chancellors for review on March 26th. The LSTF convened for a final meeting on April 2nd to endorse the strategic goals and objectives and provide input and direction where needed.

On April 7th, Chancellor Collins briefed the President and fellow chancellors on the contents of the plan. Based on their feedback, the report went through a further revision process prior to the May meeting of the President’s Council. At the May 5th President’s Council meeting, the Chancellor presented the President and campus chancellors with the final elements of the LSTF report. Following their approval, the report was distributed to key external stakeholders for final comment and endorsement.
C. Research Enterprise – Areas of Strategic Opportunity

Areas of Strategic Opportunity in Basic Science Research:

- Nucleic Acid Biology;
- Protein Biology;
- Systems Biology/Computational Biology;
- Developmental Biology;
- Biology of Aging;
- Immunology;
- Evolutionary Biology;
- Materials Science;
- Environmental Biology/Environmental Health;
- Neurobiology;
- Therapeutic target discovery;
- Drug delivery;
- Bioinformatics; and
- Mobile Health (mHealth).

Areas of Strategic Opportunity in Translational and Population-based Research:

- Health economics;
- Comparative effectiveness research;
- Outcomes measurement science;
- Implementation science and health systems improvement;
- Health disparities research;
- Genetic epidemiology;
- Advanced biostatistical modeling;
- Biomedical informatics; and
- Novel health care delivery models.