



University of Massachusetts

Amherst • Boston • Dartmouth • Lowell • Worcester • UMassOnline

LIFE SCIENCES STRATEGIC PLAN

A CLEAR PATH FORWARD

*Positioning UMass
as the State-wide Resource
for the Commonwealth's
Life Sciences Ecosystem*

November 2014

FULL REPORT

Foreword from the Chair

MICHAEL F. COLLINS, MD

*Senior Vice President for the Health Sciences, University of Massachusetts
Chancellor, University of Massachusetts Medical School*

The Commonwealth of Massachusetts, over the course of the last several decades, has built an internationally renowned and respected life sciences cluster. The key stakeholders in the Commonwealth's life sciences community, including the University of Massachusetts, contribute to and benefit from this rich and fertile innovation ecosystem. As an increasing number of metropolitan areas in the United States and nations across the globe aggressively seek to replicate the model developed here in Massachusetts, the Commonwealth's life sciences community must find new and effective ways to partner in order to preserve and advance what has been built in our state.



The report that follows provides a compelling vision for the University of Massachusetts, the state's premier public research university, focused on advancing Massachusetts in its leading role in the life sciences sector. With our statewide reach, sizable resources and diverse expertise, the University of Massachusetts is uniquely poised to animate and drive the advancement of life sciences.

The stakes are high—over 113,000 Massachusetts residents work in the life sciences and UMass plays a key role in educating the Commonwealth's future workforce. Recognizing the economic importance of this sector to the state and future UMass graduates, the UMass Life Sciences Task Force offers a vision where the University can build on the successes of its previous life sciences strategic plan and position itself in new ways to develop a rich talent ecosystem, bolster research activities and deepen our relationships with external partners.

To continue fueling Massachusetts' innovation and knowledge-based economy, the Life Sciences Task Force calls for the UMass System to renew its commitment to collaboration across the five campuses and strategically adjust to the dynamic life sciences ecosystem. Whether at the campus or system levels, we must think differently, act deliberately, and partner effectively to bring our collective strengths to bear in a sector that promises greater rewards and greater outside competition than ever before.

This report is more than a list of objectives and recommendations; it charts a path forward. It embodies the University of Massachusetts' mission to advance the lives of people of the Commonwealth and the world. It ensures that our most important, visible and lasting contribution—our graduates—will be prepared to enter, thrive and lead the Commonwealth's dynamic innovation economy in the years ahead.



Table of Contents

I.	Executive Summary.....	4
II.	Introduction.....	15
III.	Strategic Goal #1: Talent.....	19
IV.	Strategic Goal #2: Research.....	28
V.	Strategic Goal #3: External Engagement and Innovation.....	40
VI.	Implementation and Evaluation Plan.....	52
VII.	Conclusion.....	54
VIII.	Appendices	
	A. UMass Life Sciences Task Force Membership.....	55
	B. LSTF Process and Work Plan.....	57
	C. Research Enterprise – Areas of Strategic Opportunity.....	64
	D. List of Abbreviations and Additional Information.....	65



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 an updated 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 sciences strategic plan resulted in many substantive accomplishments and generated 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, established a culture of collaboration within the System, a successor planning process would provide the University with a timely opportunity to create a framework within UMass that promotes and sustains external collaborations, especially with industry partners;
- Considering the emerging paradigm shift known as convergence,¹ a way of problem-solving that integrates knowledge, tools and ways of thinking from various disciplines, UMass should proactively develop programs and platforms that enhance collaborative problem-solving across historically siloed disciplines such as the biological, physical, computational, mathematical and engineering sciences;
- 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.

¹ National Research Council. *Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond*. Washington, DC: The National Academies Press, 2014



LIFE SCIENCES STRATEGIC PLAN

- 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, would like 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 a success story for government investment and economic growth,² demonstrates 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 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

² Life Sciences Innovation as a Catalyst for Economic Growth, B. Bluestone and A Clayton-Matthews, The Boston Foundation (2013). http://www.tbf.org/~media/TBFOrg/Files/Reports/LifeSciences_%C6%92.pdf



LIFE SCIENCES STRATEGIC PLAN

University's first-ever life sciences strategic plan, demonstrate the importance of 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 per year 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 MassBiologics Southcoast Facility in Fall River, the Emerging Technologies and Innovation Center at Lowell, and the Albert Sherman Center at Worcester.
- **Leveraging complementary expertise across the University through inter-campus collaboration;** 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 value 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.

While reaffirming these core missions, the LSTF, early on in the planning effort, acknowledged that it would be working within challenging 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 in constant dollars for the life

Federal funding in constant dollars for the life sciences has been in decline, and looks to remain so for the indefinite future

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 the life sciences now extends to countries in Europe and Asia, which are mobilizing

aggressively and launching national initiatives to strengthen their life sciences sectors.

Consequently, the LSTF believed the successor planning process should respond to this external environment by emphasizing 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, continues to recognize 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 cluster, also recognizes the need to create partnerships to sustain and grow the ecosystem. This is particularly true in areas, such as training and new knowledge discovery, in which companies have traditionally 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. These strategies will be focused on 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 leverage its resources for the benefit of the Commonwealth.

With its charge defined and guiding principles developed, the LSTF set about creating an



LIFE SCIENCES STRATEGIC PLAN

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, drafted a vision statement, developed 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. In addition, working groups reached out to and interacted with important external stakeholders, among them the Massachusetts Biotechnology Council (MassBio) and the Massachusetts Medical Device Industry Council (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 herein.

For the purposes of the executive summary, the LSTF-endorsed strategic goals are organized into three overarching strategic goals with a number of accompanying strategic objectives. These goals and objectives build on the successes of the initial System-wide life sciences planning process and target key areas of further strategic engagement. 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.

These goals and objectives build on the successes of the initial System-wide life sciences planning process and target key areas of further strategic engagement

Recognizing the broader 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.

Within this 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, breadth of



LIFE SCIENCES STRATEGIC PLAN

programs and quality of research, has and will continue to make substantial, widespread investments in 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, due to the robust nature 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 from the perspective of shared investment, strategic alignment and mutual benefit. That is to say, the impact of the University's existing and new life sciences-related investments can be leveraged and maximized through a reciprocal relationship with essential external stakeholders, among them state

The impact of the University's existing and new life sciences-related investments can be leveraged and maximized through a reciprocal relationship with essential external stakeholders

government, the Massachusetts Life Sciences Center and industry groups such as MassBio 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: Talent

Develop a talent ecosystem that encourages interconnectedness among all stakeholders, ensures the highest educational quality at all levels and enables UMass graduates to find success in the state's innovation economy.

Strategic Objectives***1.1 Strengthen experiential learning opportunities, especially internships and co-ops, for UMass students interested in life sciences-related careers***

The LSTF recommends that the University of Massachusetts implement University-wide and campus-specific strategies, including the establishment of coordinator positions, a centralized clearinghouse of information related to experiential learning opportunities and formal linkages with life sciences companies, to position UMass students for success in life sciences-related professions.

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 such as regulatory science and life sciences information technology that have direct links to 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; and 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 success strategy for undergraduate students in STEM degree programs that is focused on improving retention rates, graduation rates, time to graduation and academic performance.

Strategic Goal #2: Research

Foster an innovative, collaborative and complementary research enterprise that will enhance the breadth, depth 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 foundational element of the University's life sciences strategic plan over the next five years.

2.2 Expand existing research pilot programs

The LSTF supports an increase in 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 recommends that the University engage with key government stakeholders to advocate for the prioritization of the Massachusetts Life Sciences Center's Research Cooperative Matching Grant Fund and the Commonwealth's existing R&D Matching Fund, and further recommends that both funds be made available to support federal R&D life sciences grant proposals.

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

The LSTF calls for the creation of a dedicated fund to enable UMass to compete aggressively for federal funding including especially large-scale, multi-institutional awards, so-called "center-level" grants, which would leverage state investments through its R&D Matching Grants program.



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

The LSTF endorses 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 the 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: External Engagement & 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.

Strategic Objectives***3.1 Create a five-campus network of life sciences 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 constituencies 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 proposes a more robust approach to entrepreneurship and commercialization efforts 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 2014: BUILDING ON THE SUCCESSES OF THE 2008 PLANNING PROCESS TO POSITION THE UNIVERSITY TO RESPOND TO 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.³ 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 a bold vision focused on the development of the life sciences cluster in the Commonwealth.

In 2007-2008, under the leadership of UMass Medical School Chancellor Michael F. Collins, MD, the University assembled a System-wide task force to develop the University's first-ever strategic plan in the life sciences. This effort resulted in an ambitious and deliberate multi-year plan to guide the University's development in the life sciences.

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).

From 2007 to 2013, UMass had considerable success implementing many of the mission-related recommendations. Key accomplishments from the period include the following:

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

³ UMass President's Office – FY 2013 Annual R&D Expenditures Report

- **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 per year, including a record-high of \$71 million in 2009 due to a license with Merck for treating *C. difficile* infection; and
- **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).

During the same period, UMass also achieved great success implementing a number of operational recommendations put forward by the LSTF, including:

- **Translational research model** – the UMass 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 UMass Medical School established the “Life Sciences Moment Fund” and the President’s Office continued its Science & Technology Initiatives Fund to promote inter-disciplinary and inter-campus collaborative efforts and to cultivate new and innovative research projects;
- **Collaborations** – the most visible new collaboration was the five-campus CTSA collaboration, but the University also initiated strategic partnerships with private universities and research institutes (e.g., Mass Green High Performance Computing Center in Holyoke, Center for Personalized Cancer Therapy at Boston, the Pioneer Valley Life Sciences Institute in Springfield) and industry (e.g., Amherst with Abbott/BASF, Medical School with Pfizer, Lowell with Boston Scientific); and
- **Capital investments** – approximately \$1.2 billion was 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 life sciences strategic plan coincided with the passage and implementation of the Massachusetts Life Sciences Initiative, which committed \$1 billion in capital investments, tax breaks and research support over ten years, 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 University’s success was clearly facilitated by close alignment with state government. Similarly, the previous plan has helped to advance alignment among and between



LIFE SCIENCES STRATEGIC PLAN

the five UMass campuses. Such alignment has resulted in highly synergistic inter-campus collaborative efforts that are being regularly leveraged for the benefit of the System, as well as for Massachusetts.

Over the past several years, the University of Massachusetts, working from a strategic direction, has hired world-class faculty, made considerable capital investments, obtained substantial financial support from the MLSC, increased synergistic collaboration across the campuses and created a conscious focus on translational research. These activities have helped the University position itself as a major asset for the life sciences ecosystem in Massachusetts. This was confirmed in MassBio's recently published strategic plan entitled, "Impact 2020: Advancing Massachusetts Leadership in the Life Sciences for Patients,"⁴ which highlighted the University's unique and essential position within the Commonwealth's life sciences community. The report noted that "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."

"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."
-MassBIO Impact 2020 Report

New Strategic Directions

The University of Massachusetts, as the state's premier 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 campuses and key hiring of world-class faculty.

However, 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 constant-dollar decline and faces an uncertain future in the current political environment. Major life sciences companies are approaching research and development efforts in different

⁴Massachusetts Biotechnology Council's "Impact 2020: Advancing Massachusetts Leadership in the Life Sciences for Patients"
http://www.massbio.org/writable/editor_files/impact_2020_full_report_04032014_email.pdf

ways and, as a result, the nature of their relationships with universities is evolving. 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.”⁵ Finally, with the election of a new Massachusetts governor in the coming year, the prospect of continued robust support from the state government for the life sciences is yet to be determined.

In this 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). The LSTF 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 Appendix A. Furthermore, Chancellor Collins selected members from the larger LSTF membership to serve in the LSTF Stewardship Group, a body whose goal was to ensure proper coordination among the campuses. Owing to their instrumental role in the development of this report, the Stewardship Group members deserve special mention:

- **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, Former 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; and
- **System Office** - Tom Chmura, Vice President for Economic Development.

For additional information on the LSTF’s process and work plan please see Appendix B.

⁵ 2014 Global R&D Funding Forecast, Battelle, December (2013).
http://www.battelle.org/docs/tpp/2014_global_rd_funding_forecast.pdf?sfvrsn=4



III. Strategic Goal #1 – Talent

DEVELOP A TALENT ECOSYSTEM THAT ENCOURAGES INTERCONNECTEDNESS AMONG ALL STAKEHOLDERS, ENSURES THE HIGHEST EDUCATIONAL QUALITY AT ALL LEVELS AND ENABLES UMASS GRADUATES TO FIND SUCCESS IN THE STATE’S INNOVATION ECONOMY.

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 develop and nurture a talent ecosystem that increases interconnectedness among stakeholders, ensures the highest academic quality across the educational continuum and enables an increasing number of UMass graduates to find success in and add value to the state’s life sciences innovation economy.

UMass is developing innovative and fresh approaches focused on the development of its students pursuing life sciences majors. In deeply considering this talent approach, the LSTF wanted to ensure that it would be as contemporary and effective as possible. Further, the LSTF considered the need to effectively communicate the strategy, often through the use of evocative metaphors. The widely used pipeline metaphor seems now to reflect an outdated industrial age mindset, where students are “loaded” into a pipeline and delivered to a final destination, without further engagement with outside forces and influential actors. This is a limited metaphor that does not accurately reflect today’s student development.

Moving forward, the LSTF talent development strategy is better represented by an ecosystem metaphor. The ecosystem includes a stream or a river of talent, interacting in continuous and important ways with other surrounding elements of the talent development environment. A healthy and productive river would depend on close interactions with many sectors and stakeholders. The river can also become unproductive or even obstructed by several different types of barriers. The University’s goal should be to develop a sustainable, strong, and healthy ecosystem, allowing all sectors and stakeholders to enjoy healthy and productive growth. To develop a strong workforce and leadership cadre in the life sciences, UMass must interact and collaborate with all public and private sectors of the life sciences ecosystem. This approach is intended to maintain and enhance Massachusetts’ global leadership in this sector, and UMass has a crucial role to play as the Commonwealth’s premier public research university.

The LSTF renews the University’s fundamental and unique commitment to educating the Commonwealth’s future STEM-related workforce. In considering the comprehensive nature of this significant commitment, the LSTF recommends that the University develop and nurture a stream of talent from undergraduates, all the way through to graduate students, postdoctoral fellows, and junior faculty. This would increase interconnectedness among stakeholders, ensure the highest academic quality across the educational continuum and enable an increasing number of UMass graduates to find success in and add value to the state’s life sciences

innovation economy. 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.

This is especially true when considering that over four-fifths of UMass undergraduates are Massachusetts' residents, as compared to 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.

Although the talent development strategy spans the educational continuum, it is imperative to invest at its front-end. Consequently, the University should prioritize efforts focused on improving the success of the University's undergraduate students in STEM degree programs. Fortunately, the University can draw upon some existing models that have demonstrated results. Those include UMass Boston's highly effective Student Success Center within the College of Science and Mathematics and UMass Amherst's STEM Diversity Institute. 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. The strategy, however, cannot be confined to only the University. As mentioned above, UMass students serve as the foundation of the state's workforce. It is, therefore, incumbent on the University to extend its talent development strategy to external stakeholders in the life sciences sector by developing specialized degree programs linked to industry needs and experiential learning opportunities for UMass students. By doing so, the University will position its graduates entering the Commonwealth's competitive life sciences sector for professional success.

With this as context, the LSTF recommends the following strategic objectives that support a comprehensive talent development strategy and promote the University's central role in strengthening the Commonwealth's global leadership position in the life sciences.

Strategic Objectives

1.1 Strengthen experiential learning opportunities, especially internships and co-ops, for UMass students interested in life sciences-related careers.

The LSTF recommends that the University of Massachusetts implement University-wide and campus-specific strategies, including the establishment of coordinator positions throughout the five-campus System, a centralized clearinghouse of information related to experiential learning opportunities and formal linkages with life sciences companies to position UMass students for success in life sciences-related professions.



LIFE SCIENCES STRATEGIC PLAN

Although some of the UMass campuses have taken active steps to improve experiential learning opportunities for their students, the UMass System historically 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.

Given the breadth and depth of the System and the quality of the UMass student population—Massachusetts’ future workforce—the University could very well position itself as a statewide leader in experiential learning and emerge as the first choice for life sciences companies interested in hosting internships, co-ops or other immersive learning opportunities.

Given the breadth and depth of the System and the quality of the UMass student population—Massachusetts’ future workforce—the University could very well position itself as a statewide leader in experiential learning

Experiential and immersive learning opportunities pay immediate and long-lasting dividends for the University, generally, and its student population, in particular. The most common vehicle from which to pursue experiential learning is through internships. Internship programs allow students and employers to form strong relationships 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 internship program, for example, could include a coordinator position at the President’s Office and dedicated senior staff positions on the campuses. Coordinators, in conjunction with the System Office, could help to drive formal linkages with life sciences companies to open up experiential learning opportunities across the state. Furthermore, the coordinators could oversee the development of an online platform that consolidates internships designated for UMass STEM students. Such a platform would include relevant internship information such as qualifications, application deadlines, class credit eligibility and compensation. In addition, this platform could provide information on internships offered through the MSLC, NIH, NSF and other entities.

UMass has a tremendous opportunity in this area and, as a result, the LSTF strongly endorses a System-wide approach that leverages the geographical diversity of the campuses



and the unique and complementary expertise found across the UMass System. The creation of a University-wide working group focused on strengthening the University's infrastructure necessary to support a robust experiential learning program would be a critical first step. Such an approach would necessitate the input and contributions of key University-based constituencies, including: System-wide administrators and leaders working in the System-office; campus chancellors and provosts; faculty and staff engaged in academic programming and industry relations; students; and UMass alumni living in Massachusetts.

With respect to this last constituency, the University's 266,000 proud alumni residing in the

The University's 266,000 proud alumni residing in the Commonwealth represent an established and influential network that can help UMass enhance its experiential learning opportunities

Commonwealth represent an established and influential network that can help UMass enhance its experiential learning opportunities. UMass alumni are embedded throughout the state's life sciences sector and are contributing to its current success and future direction. By making a concerted effort to reach out and engage with this key stakeholder

group, the University could greatly expand its internship and co-op offerings, thereby expanding opportunities for current and future UMass students.

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, such as regulatory science and life sciences information technology, that have direct links to life sciences industry needs in Massachusetts and, thus, position UMass graduates for long-term success in the workforce.

Existing and influential industry associations, most particularly MassMEDIC, MassBio and MassBioEd, will be critical to this initiative. As a result, the LSTF believes that the University should engage closely with these entities to develop rigorous and meaningful programs that will serve the UMass student body well for careers in the life sciences sector.

Academic programs focused on regulatory science, for example, could be implemented expeditiously. 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. There is a dearth of regulatory science degree programs within the public higher education system in



Massachusetts, and industry stakeholders have identified the lack of qualified regulatory science graduates as a major impediment to 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. Given the size and extent of the Commonwealth’s biotechnology sector, there is a growing need for regulatory science expertise to support the requirements, regulatory and otherwise, of this burgeoning industry.

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.

Another emerging area of strategic importance for the Massachusetts life sciences cluster is life sciences information technology (LSIT). In its recently published strategic plan entitled, “Impact 2020: Advancing Massachusetts Leadership in the Life Sciences for Patients,” MassBio put forward LSIT as a major thematic area for the Commonwealth’s life sciences community in the years ahead. The Biotechnology Council wrote that “Massachusetts has an important opportunity to take the lead in developing information-based solutions that increase efficiency and mitigate risk at all levels of the biopharma value chain, from basic research to patient care.”

The LSTF is appreciative of MassBio’s strategic focus on strengthening the Commonwealth’s leadership position in this increasingly critical field. Moreover, the LSTF believes that the University could play a key role in the statewide life sciences information technology effort by leveraging existing LSIT expertise on the campuses, particularly on the Amherst and Worcester campuses, and the University’s engagement with the Mass Green High Performance Computing Center. Consequently, the LSTF recommends that the University position itself as a resource to help advance one of the major themes from the Biotechnology Council’s “Impact 2020 Report.”

The University could play a key role in the statewide life sciences information technology effort by leveraging existing LSIT expertise

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.



LIFE SCIENCES STRATEGIC PLAN

The life sciences sector in Massachusetts supports over 113,000 jobs, which ranks sixth in the nation for total life sciences employment and first, by far, on a per capita basis.⁶ Expanding and strengthening the talent pool to satisfy this robust sector require unique 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.

The life sciences sector in Massachusetts supports over 113,000 jobs, which ranks 6th in the nation for total life sciences employment and 1st, by far, on a per capita basis

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 dynamic statewide life sciences ecosystem. Well-trained graduates and post-doctoral associates translate into a high quality workforce that is more likely to perpetuate productive relationships between industry partners and UMass faculty members in the future.

The University System, in general, and the Worcester campus, in particular, already offers specially designed programs to doctoral students interested in non-academic careers. The Medical School's recent receipt of an NIH BEST grant⁷ to help train doctoral students for careers in industry demonstrates the University's increasing focus on providing its graduate students with a strong foundation to succeed in the state's life sciences sector. By incrementally 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.

Such a commitment will encourage applicants to consider applying to UMass for education and training programs. Moreover, branding the recipients of this competitive fellowship program as "Commonwealth Fellows" 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

⁶ Barry Bluestone and Alan Clayton-Matthews, "Massachusetts Life Sciences Employment: 2010 – 2012," June 2014. Dukakis Center for Urban and Regional Policy at Northeastern University

⁷ UMassMedNow Article, "NIH grant integrates career planning with scientific training:" <http://www.umassmed.edu/news/news-archives/2014/02/NIH-grant-integrates-career-planning-with-scientific-training/>



participate in an annual symposium intended to bring faculty and students together to facilitate scientific exchange and interaction between 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 or 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 until the time they are promoted to associate professor. The position will then be vacated and made available to recruit or retain an 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; and 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 the Presidential Scholar funding 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 within the entire talent ecosystem. Central to this strategy is a robust focus on improving the success of the University's undergraduate students in STEM degree programs.

UMass must vigorously pursue initiatives that enrich the educational and professional experiences within the entire talent ecosystem

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. It is reasonable to assume 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.⁸ Genzyme's donation is a model example of how a campus-based investment that is 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.

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



LIFE SCIENCES STRATEGIC PLAN

The UMass System would 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 would be ultimately responsible for the positive outcomes and in charge of identifying and implementing evidence-based approaches and best 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.



IV. Strategic Goal #2 – Research

FOSTER AN INNOVATIVE, COLLABORATIVE AND COMPLEMENTARY RESEARCH ENTERPRISE THAT WILL ENHANCE THE BREADTH, DEPTH 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 sustained contributions to the broader economic and social development of the Commonwealth via a robust research portfolio, which, according to a 2013 report, was ranked 3rd in Massachusetts and accounted for more than 18% of total R&D expenditures for all Massachusetts institutions. Moreover and in 2013, UMass ranked 4th in New England and 33rd nationally with respect to annual R&D expenditures.⁹ 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 among the top fifteen institutions 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 given the current political milieu. Major life sciences companies are approaching research and development efforts in different ways and developing new models for partnering 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 yet to be determined.

Major life sciences companies are approaching research and development efforts in different ways and developing new models for partnering with universities

⁹ UMass President’s Office FY2013 Annual R&D Expenditures Report

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 appears to be a harbinger of an increasingly constrained and competitive 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 limited success 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 is uniquely positioned to operate successfully in the emerging paradigm shift toward convergence, where faculty colleagues representing varied disciplines will come together in a holistic fashion to shape comprehensive and collaborative responses to current and future research opportunities and problems. Furthermore and although the research funding environment is, indeed, constrained, the University will, nevertheless, continue to play a key role in sustaining the state's leadership position in the life sciences, as evidenced by its robust research enterprise that generated \$329 million in expenditures in FY'13.

The strategic objectives that follow take advantage of the University's dynamic interdisciplinary faculty networks and research strengths, as well as anticipated future funding opportunities from federal agencies, such as the NIH, NSF, AHRQ, DARPA, PCORI, DOE and MCHB. Additionally, the objectives will help to 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 industry partnerships will be a critical component of the University's R&D portfolio.

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 translational research and training initiatives. 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 in July 2010 to create a framework from which to coordinate clinical and translational science education, training and research across all



LIFE SCIENCES STRATEGIC PLAN

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 of the UMass community across the five campuses to collaborate around clinical and translational research and education. The annual UMCCTS retreat has consistently grown in size and scope, and the 2013 retreat included over 350 participants from across the System. Similarly, pilot funding programs, in particular the Life Sciences Moment Fund (LSMF), have catalyzed the formation of new teams of investigators from multiple campuses, as well as generated excellent returns on the University's 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 of UMass Medical School remains a unique and premier facility for biologics discovery, production, and contract manufacturing. A recent grant from the MLSC will help to support a new cGMP viral vector facility that capitalizes on the UMass Medical School's world-class gene therapy program. The UMCCTS-Mass Biologics Next Hundred Million Dose Pilot Grant Program provides an 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 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 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.

M2D2 has assisted 100 medical device companies to raise over \$24 million in private investment funds and \$5 million in grants

Approximately 40 students have interned with M2D2 since its inception. In March 2014, the MLSC invested an additional \$4 million in M2D2 to create the Big Company/Little Company



LIFE SCIENCES STRATEGIC PLAN

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 and Amherst campuses such as MassDrug and the Institute for Applied Life Sciences (IALS), respectively, 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.

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

By continuing to build capacity for clinical and translational research throughout the five campuses, the UMass System will help to develop products that advance human health in addition to generating economic benefits for the state

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 the five campuses, the UMass System will help to develop products that advance human health in addition to generating economic benefits for the state.

Considering the central role of the UMCCTS in building the translational science and training ecosystem at the System level, 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 of the utmost importance that the University retain the CTSA grant 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 MLSC on the development of the next phase of the grant award.

It is of the utmost importance that the University retain the CTSA grant to maintain and build upon the momentum that UMass has gained

2.2 Expand existing research pilot programs

A major recommendation from the initial life sciences strategic plan was the establishment of life sciences specific seed funding. Considering the past success of these funding programs in terms of connecting faculty members at different campuses and leveraging additional external funds, the LSTF supports increasing the funding for the University's existing research pilot programs. Those include: 1) the UMCCTS Life Sciences Moment Fund; 2) President's Science and Technology Initiatives Fund; and 3) 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 different fields, such as engineering and biology, or chemistry and medicine. These programs align with the paradigm shift toward convergence¹⁰, a way of approaching research problems that cuts across disciplinary silos. Experience in interdisciplinary research may benefit the University in future grant applications that reward institutions with a track record of collaboration in multiple fields. 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.

These programs align with the paradigm shift toward convergence, a way of approaching research problems that cuts across disciplinary silos

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. Furthermore, the University should more aggressively take advantage of its existing system of honorific professorships and increase the number of endowed faculty appointments to recruit exceptional faculty in areas of strategic importance.

¹⁰National Research Council. Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond. Washington, DC: The National Academies Press, 2014

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

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

research investments in the years ahead (please see Appendix C 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 Appendix C 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 Dr. Craig Mello, *Blais University Chair in Molecular Medicine*, and ongoing efforts in RNA therapeutics, gene therapy, epigenetics, and microbiomics across the University. New opportunities in protein biology have been spearheaded in the Models to Medicine Center within UMass Amherst's Institute for Applied Life Sciences (IALS), 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.

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 Center (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 in 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 inter-campus 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 and addressing major policy changes such as the Affordable Care Act. 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 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 multi-billion dollar federal 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 Research. Becoming one of the nation’s leaders in this arena is within the University’s reach, but requires expansion of UMass’s content expertise 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 biostatistical modeling is crucial for serious population research efforts, and although the University has capacity in this area, especially on the Amherst and Worcester campuses, considerably more resources are needed to bring the University’s methodological research to a nationally respected level.

The twenty-three strategic areas of opportunity (please refer to Appendix C) 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 stakeholders. 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 research areas identified are clearly representative of new industry investments in the Commonwealth's biotech sector, which 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,¹¹ 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.

Most importantly, the research areas identified are clearly representative of new industry investments in the Commonwealth's biotech sector, which remains highly focused on rationally-designed drugs, biologics and devices

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

The LSTF strongly recommends that the University engage with the leadership of the Massachusetts Life Sciences Center to advocate for the prioritization of the MLSC's Research Cooperative Matching Grant Fund, the goal of which is to increase industry partnerships with Massachusetts-based research institutions that will "lead to the commercialization of translational research." In addition, the LSTF further recommends that both the MLSC's Research Cooperative Matching Grant Fund and the Commonwealth's existing R&D Matching Fund be made available to support federal R&D life sciences grant proposals.

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

¹¹ UMassMedNow Article, Voyager Therapeutics targets novel gene therapies to combat diseases:" <http://www.umassmed.edu/news/news-archives/2014/02/voyager-therapeutics-targets-novel-gene-therapies-to-combat-diseases/>



LIFE SCIENCES STRATEGIC PLAN

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. This fund is in addition to the Massachusetts Life Sciences Center's Cooperative Research Matching Grant program. It should be noted that the University has already benefitted from the state's R&D Matching Grant program. The Lowell campus received \$4 million to match a \$12 million Raytheon-led industry investment on the campus in the field of flexible electronics.

While both cost-matching mechanisms demonstrate the state's commitment to enhancing the Commonwealth's R&D competitiveness, neither provides state matching funds to help pursue federal R&D life sciences funding. In the case of the MLSC Research Cooperative Matching Grant Fund, it is a relatively modest \$2 million fund that only matches industry R&D

While both cost-matching mechanisms demonstrate the state's commitment to enhancing the Commonwealth's R&D competitiveness, neither provides state matching funds to help pursue federal R&D life sciences funding

grants. With respect to the Commonwealth's \$50 million R&D Matching Grant Fund, there is a preference to support non-life sciences and non-clean energy R&D initiatives so as not to duplicate the purposes of the Massachusetts Life Sciences Center and the Massachusetts Clean Energy Center. Interestingly, the Clean Energy Center has chosen to provide matching funds to federal clean energy R&D proposals, while the Life Sciences Center has yet to develop a mechanism to provide matching funds to federal life sciences R&D proposals.

The prioritization 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 University 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 recognizes the level of effort, energy and coordination required to submit successful grant proposals. 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 to meet this increasing need, the University’s research enterprise would benefit greatly from a mechanism that is focused solely on supporting large grant proposals from UMass researchers.

The University’s research enterprise would benefit greatly from a support mechanism to support large grant proposals from UMass researchers.

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 of paramount importance to UMass researchers and industry partners. The cost of obtaining and maintaining expensive research equipment can be prohibitive for an individual research group or start-up company. As an example, a new Transmission Electron Microscope costs approximately \$1 million. Even if capital funds are obtained for the initial purchase, the annual operating costs associated with maintaining and servicing 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, such as: (1) reducing the duplication of purchase and support of similar instruments; (2) enabling the purchase of higher-end instruments and/or a broader spectrum of capabilities by pooling resources; (3) promoting opportunities to assist and strengthen collaborations with other researchers, including industry; (4) reducing subsidies required to maintain technical facilities; and (5) creating staff efficiencies.

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

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

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 sciences and health needs. Such an effort would be aligned with and in support of the trend toward convergence, which, as stated previously, is a way of approaching problems and research that cuts across traditional disciplinary silos. 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 #3 – External Engagement and 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)** 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)** 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 MassBiologics Southcoast Facility** 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 bio-manufacturing 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;
- **The Massachusetts Technology Transfer Center**, 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**, 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 Commonwealth’s innovation economy, including the following:

- **Medical Devices** (organized by Mass Medic) – with Philips, Smith & Nephew, J&J, Medtronic;
- **R&D** (organized by MassBio and hosted by Vertex) – with Vertex, Cubist, Genzyme, Novartis, Capsugel, J&J;
- **Talent** (sponsored by MassBio as part of their strategic planning) – with Genzyme, Parexel, Millenium/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 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 cluster in Massachusetts, including but not limited to medical devices, advanced manufacturing, drug development and bio-manufacturing. 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 would, therefore, be to spur 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 a System, rather than a collection of five independent campuses.

Many potential industry partners perceive UMass as 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

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 Cooperative Research and Development Agreements with the U.S. Army’s Natick Solider Research Development and Engineering Center). 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 resource for the state’s bio-manufacturing community, the MassBiologics Southcoast Facility, based in Fall River will soon be operational, adding another

component 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.

Developing a Campus-based Model for Industry Engagement: *UMass Amherst's Institute for Applied Life Sciences*

With the goal of fostering translational research, the UMass Amherst Institute for Applied Life Sciences (IALS) was conceived with substantive input from industry. More than 150 representatives from 100 life science companies from across New England and beyond participated in the planning process, which generated a vision for an applied research institute comprised of three centers built on campus strengths and aligned with industry stakeholder interests. The iterative process developed in three phases.

First, through a series of a dozen workshops held in Boston and Amherst, industry scientists and executives participated in facilitated ideation sessions. Industry participants proposed problem-opportunities where UMass Amherst research could address technology-limiting knowledge gaps.

Second, through multiple alignment meetings, more than 90 campus faculty members representing 16 academic departments and 4 colleges identified the best matches between those problem-opportunities and campus research strengths.

Third, faculty "pressure-tested" their research center concepts through presentations to panels of industry scientists. Of the many concepts considered and developed during this process, three were selected for advancement: 1) the Center for Bioactive Delivery; 2) the Models to Medicine Center; and 3) the Center for Personalized Health Monitoring and Biometric Sensors. Twelve new faculty lines, earmarked for translational researchers, have been committed by Chancellor Subbaswamy to these centers. Each of the centers, now all a part of IALS, was expressly conceived to catalyze translational research in human health and foster mutually beneficial university-industry partnerships aimed at creating the scientific and technological foundations for new commercial products and services.

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 a two-pronged approach: 1) a focus on increasing awareness among external partners in the state; and 2) a focus 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, although it has a very large and impactful research enterprise, Massachusetts companies, by and large, do not appreciate nor understand the breadth and depth of the University's research activities. In cases where industry has worked closely with UMass, or in very specific research areas (e.g., polymers, nano-manufacturing, 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.

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 aimed at addressing the dichotomy between the external perception and current reality of the UMass R&D enterprise. Specifically, this outreach initiative would improve the University's level of awareness and reputation among industry and promote robust industry partnerships focused on medical devices, pharmaceuticals, biologics, biomarkers/diagnostics, novel drug delivery methodologies, informatics (health IT and bioinformatics), and bio-manufacturing .

This plan should include:

- Development of a systematic approach to industry engagement, building on programs such as the UMass Innovation Institute, Massachusetts Medical Device Development Center, Advanced Technology Manufacturing Center and Venture Development Center;

- Regular engagement with companies and industry advisory groups, including MassMEDIC, MassBIO and others (e.g., the Bio-Manufacturing Roundtable) and establishment of 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 and pilot proposals; 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.

The University should have seats on the boards of MassMedic and MassBIO and have faculty and staff actively engaged on their committees.

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, 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 more targeted and robust approach to entrepreneurship and commercialization on the campuses.

During the information-gathering stage of the LSTF process, it was gleaned that members of the life sciences community perceive the UMass campuses as lacking the resources, programs and expertise to effectively commercialize UMass discoveries. While steps have been taken to improve commercialization capabilities on the campuses, the University needs to act aggressively to turn this perceived weakness into an institutional strength. 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:

1. 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 proof of concept funding has been included in the 2014 economic development bill that has been passed by the Massachusetts Legislature and signed by the Governor. The bill provides an initial allocation of \$2 million in funding, with at least one-half being reserved for UMass.
2. UMass would benefit from a 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 MassDrug and UMass Lowell's Medical Device and Development Center. In conjunction with the 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 more robust educational offerings that will help investigators understand the start-up process.

This effort should focus initially on the recruitment of alumni who have the expertise and interest in working with the campuses

3. UMass should find ways to support spin-off companies as they raise their initial rounds of funding. 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. 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 example, in FY 2014, the University was 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. Moreover, the task force has conducted the first-ever System-wide retreat on entrepreneurship and, based on the retreat, identified an agenda that will promote mentoring, business competitions, "entrepreneurs-in-residence" and entrepreneurial education.

3.4 Creation of a Life Sciences Investment Fund to support innovative and multi-campus research initiatives

Over the course of the last several 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 the University's expertise 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, referenced throughout this report, which already are transforming the University's research enterprise for the benefit of the broader life sciences ecosystem in the state.

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.

Included below are a number of examples that meet the above criteria and would benefit from a dedicated Life Sciences Investment Fund.

1. Small Molecule Screening Facility (MassDrug & 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 on 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.

2. 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 \$40 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 on 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 supports the UMCCTS priority goal of developing products that improve human health. Product licensing or company spinoffs would contribute to increased System revenues and economic development through job creation.

3. Center for Robot-Assisted Home and Rehabilitation Care

Robot-assisted living and therapy represents a rapidly growing field due to the increase in the number of aging adults who wish to remain in their homes longer and individuals 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 would also benefit from access to the facility and to the UMass expertise brought together in this Center.

4. 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 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; 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 sciences 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.

5. 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 conditions 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 the 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 research efforts 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, that strategically positions the University 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. During the 2014 – 2015 Academic Year, a reconstituted LSTF will organize into three broad implementation work groups (Talent; Research, External Engagement & State-wide Innovation), which will be responsible for developing implementation plans for each of the three strategic goals. An LSTF Stewardship Committee will be charged with leading the overall implementation effort. The Steering Committee, in conjunction with the implementation work groups, will conduct a number of implementation-related activities, examples of which include the following:

- 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 experiential learning 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;
 - "Validating Science Initiative" Working Group; 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



LIFE SCIENCES STRATEGIC PLAN

successful in creating and fulfilling the ambitious initiatives articulated in the 2008 plan. The forthcoming implementation process 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 a talent ecosystem; 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 System must offer a compelling vision and unmatched value proposition to the key stakeholders of the life sciences community

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. Appendices

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 Medical School

UMASS LSTF STAFF

Brendan H. Chisholm

Chief of Staff – Chancellor’s Office, UMass Medical School

Nate Hafer, PhD

Director of Operations, UMass Center for Clinical and Translational Sciences

Peter J. Laub

Graduate Intern – Chancellor’s Office, UMass Medical School

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, PhD, RN, FAAN

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

Director, Center for Personalized Cancer Therapy (CPCT)
Alton J. Brann Distinguished Professor in Biological Sciences

Zong-Guo Xia

Vice Provost for Research & Strategic Initiatives
Professor of Environmental Earth and Ocean Sciences

UMASS DARTMOUTH

Erin Bromage, PhD

Associate Professor of Biology

Catherine C. Neto, PhD

Professor of Chemistry and Biochemistry



LIFE SCIENCES STRATEGIC PLAN

James A. Fain, PhD, RN, BC-ADM, FAAN

Former Dean and Professor of Nursing

Louis Goodman, PhD

Vice Chancellor for Research and Economic Development

Tesfay Meressi, PhD

Associate Provost for Graduate Studies

Paul Vigeant, MPA

Former Assistant Chancellor for Economic Development

UMASS LOWELL

Susan Braunhut, PhD

Professor of Biological Sciences

Julie Chen, PhD

Vice Provost for Research, Professor and Co-Director for Mechanical Engineering

Mark Hines, PhD

Acting Dean, College of Sciences
Professor of Biological Sciences

Steve McCarthy, PhD

Director and Professor of M2D2 and Plastics Engineering

Mingdi Yan, PhD

Professor of Organic/Materials Chemistry

UMASS MEDICAL SCHOOL

Terence R. Flotte, M.D.

Executive Deputy Chancellor, Provost, Chief Research Officer, & Dean, School of Medicine

Catarina Kiefe, MD, PhD

Chair and Professor of Quantitative Health Sciences

Mark Klempner, MD

Executive Vice Chancellor, MassBiologics of UMMS

Katherine Luzuriaga, MD

Professor of Molecular Medicine, Pediatrics, and Medicine

Director, UMass Center for Clinical and Translational Science

Vice Provost, Clinical and Translational Research

Gyongyi Szabo, MD, PhD

Associate Vice Provost for Translational Education

Director, MD/PhD Program

Professor and Vice Chair for Research

UMASS SYSTEM OFFICE

Tom Chmura

Vice President for Economic Development

John Cunningham, PhD

Chief Executive Officer, UMass Online

Vice President of Academic Affairs, Student Affairs & International Relations

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 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)– Vertex, Cubist, Genzyme, Novartis, Capsugel, J&J



LIFE SCIENCES STRATEGIC PLAN

- Talent (sponsored by MassBio as part of their strategic planning) – with Genzyme, Parexel, Millenium/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:

1. 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)?
2. 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)?
3. What would be a key factor to your use of core research facilities on another campus?
4. 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?



LIFE SCIENCES STRATEGIC PLAN

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>. 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:

Campus	Date	Time	Location
Amherst	October 8	3 – 5 pm	Student Union Ballroom
Boston	October 10	3 – 5 pm	Venture Development Center
Dartmouth	October 3	1 – 3 pm	Library -Grand Reading Room
Lowell	October 1	3:30 – 5 pm	Southwick, Room 240
Worcester	September 26	9 – 10 am	Lazare Research Building, Room 203

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 MassBio 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 a talent ecosystem** – encourage interconnectedness among all talent stakeholders, thereby ensuring the highest quality of education at all levels and enabling UMass graduates to find success in the state’s innovation economy.
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 a talent ecosystem. 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.



LIFE SCIENCES STRATEGIC PLAN

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.

The final draft of the LSTF Report was distributed to the University's Board of Trustees for review and discussion. Chancellor Collins presented an overview of the plan to the trustees at their June 17th Committee of the Whole Meeting. The Chancellor was joined by campus representatives, including: Vice Chancellor Michael Malone from the Amherst campus; Dean Andrew Grosovsky from the Boston campus; Associate Provost Tesfay Meressi from the Dartmouth campus; Vice Provost Julie Chen from the Lowell campus; Provost Terry Flotte from the Worcester campus; and Vice President Tom Chmura from the System Office.

Following the Committee of the Whole presentation, the LSTF report received further editing before being published in the fall of 2014. The LSTF's Executive Summary and Final Report will be broadly disseminated to the University community and key external stakeholders beginning in November of 2014. The formal release of the final report will coincide with the start of the implementation process.

C. Research Enterprise – Areas of Strategic Opportunity

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).

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.



D. List of Abbreviations and Additional Information

Abbreviation	Full Name	Website
AHRQ	Agency for Healthcare Research and Quality	ahrq.gov
ATMC	Advanced Technology and Manufacturing Center	atmc.umassd.edu
CPCT	Center for Personalized Cancer Therapy	umb.edu/cpct
CTSA	Clinical and Translational Science Award	ctsacental.org
CVIP	Commercial Ventures and Intellectual Property	cvip-umass.org
DARPA	Defense Advanced Research Projects Agency	darpa.mil
DOE	Department of Energy	science.energy.gov
IALS	Institute for Applied Life Sciences	umass.edu/ials
LSTF	Life Sciences Task Force	umassmed.edu/chancellor/Health-Sciences/Life-Sciences-Task-Force
MassBio	Massachusetts Biotechnology Council	massbio.org
MassBioEd	Massachusetts Biotechnology Education Foundation	https://www.massbioed.org/
M2D2	Massachusetts Medical Device Development Center	uml.edu/Research/Centers/M2D2
MassMEDIC	Massachusetts Medical Device Industry Council	http://www.massmedic.com/
MATTC	Massachusetts Technology Transfer Center	mattcenter.org/
MCHB	Maternal and Child Health Bureau	http://mchb.hrsa.gov
MGHPCC	Massachusetts Green High Performance Computing Center	mghpcc.org
MLSC	Massachusetts Life Sciences Center	masslifesciences.com
NCATS	National Center for Advancing Translational Studies	ncats.nih.gov
NIH	National Institutes of Health	nih.gov
NIST	National Institute of Standard and Technology	nist.gov
NSF	National Science Foundation	nsf.gov
PCORI	Patient-Centered Outcomes Research Institute	pcori.org
PVLSI	Pioneer Valley Life Sciences Institute	pvlsi.org
UMCCTS	University of Massachusetts Center for Clinical and Translational Science	umassmed.edu/ccts
UMII	Umass Amherst Innovation Institute	umii.umass.edu
VDC	Venture Development Center	umb.edu/vdc

Works consulted for the *Foreword from the Chair*: Iz

- UMass President’s Office – FY 2013 Annual R&D Expenditures Report
- Massachusetts Biotechnology Council’s “Impact 2020” Report
- Barry Bluestone and Alan Clayton-Matthews, “Massachusetts Life Sciences Employment: 2010 – 2012,” June 2014. Dukakis Center for Urban and Regional Policy at Northeastern University
- Hon. James McGovern Commencement Speech to UMass Medical School , June 1, 2014