# GETTING TO

Prepared for MEDCO by Biomedical Growth Strategies and Goldberg Consulting LLC

## AUGUST 2017







August 31, 2017

The Honorable Lawrence J. Hogan, Jr. The State House 100 State Circle Annapolis, MD 21409

Dear Governor Hogan,

Thank you again for your vision and commitment to form Excel Maryland, a unique partnership bringing together the private sector, the public sector, and academia to craft a bold new plan to support economic growth through the advanced industries, such as cyber security and life sciences, in Maryland.

The attached report, *Excel Maryland: Getting to #1*, represents the initial phase of this work. The analysis contained herein was overseen by a diverse group of leaders whom you appointed to serve as the Steering Committee. This report is the first step in responding to your charge to chart a course for Maryland to grow our leadership position in cyber security and life sciences. In it, you will find insights that begin to lay a foundation for a strategy for growth that is based on an initial assessment of both our strengths and our opportunities as a state. The report makes a clear case that we, in Maryland, are poised for strong leadership, even dominance in these areas, but it is imperative we take action to ensure this possibility is achieved.

The efforts of Excel Maryland, launched on May 18 at the Governor's Business Summit and conducted under the direction of the Maryland Economic Development Corporation, have provided a unique opportunity to convene key stakeholders from across our state. Our institutions have uncovered common ground among key issues raised in the analysis and are now united around a mission of accelerating our most promising advanced industry sectors to drive significant economic growth and innovation for decades to come. Together, with our private sector leaders who contributed experience, knowledge and insights gleaned from years of building economic engines in these fields, we have taken this first step to lay the groundwork to accelerate economic development in our advanced industries.

The analysis in the report tracks four areas: (1) an assessment of Maryland's enablers of innovation; (2) an assessment of Maryland's ecosystem effectiveness; (3) a gap analysis to identify high priority areas for action; and (4) key priorities and policy recommendations. The key findings note Maryland's many strengths – including a unique and powerful array of public and private assets and programs throughout the state as well as our many collective successes. At the same time, the findings candidly highlight areas for improvement, notably the imperative for

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strategic coordination and collaboration among public and private assets in both cybersecurity and life sciences to address a fragmented ecosystem that lacks the cohesion necessary to unlock our full potential as a state.

Subsequently, we are pleased to report that this analysis indicates your initial vision - that Maryland become the cybersecurity capital of the world, and a leader in key areas of life sciences - is both achievable and sustainable. However, the report also notes this can only be realized if we coordinate and focus our efforts with strategic intent on the opportunities identified, including: (1) building a focal point for an integrated strategy; (2) pursuing steps to attract capital more easily; (3) developing efforts to attract, train and retain both top executive talent and a highly skilled workforce; and (4) forging a unified Maryland story that markets to the world our successes and opportunities for growth. It is worth noting one key priority identified by the consultants that could serve as an initial consideration for our next phase of work. Specifically, the consultants' recommended that Maryland establish a support system for entrepreneurship by developing a single coordinating entity to serve as a one stop shop for a host of stakeholders. This entity would be charged with coordinating investments and incentives, marketing, industry outreach, and key business development functions. The form and function of this entity has been a focal point of discussion among the Steering Committee and with the consultants during this initial phase. While we initially examined a range of options, we recommend to you that further careful examination and development of the proper organization for Maryland be a primary next step for the Excel Steering Committee, working with your Administration.

We thank you for having the vision and the leadership to launch Excel Maryland. Even with Maryland's strong economic performance in recent years you continue to push for ways to achieve lasting economic growth, focusing on our inherent strengths. Our visions are aligned, and we see this work as a call to action, and an opportunity that cannot be missed. We know that other states are making strategic investments, and we must collectively do the same. Maryland's public and private sectors both see great promise in developing a strategy that coordinates our assets, resources, and expertise in order to accelerate further Maryland's cybersecurity and life science sectors. And we are all committed to making choices that focus our efforts to this end.

We are confident that by working together, and with your steadfast support, Maryland can achieve preeminence in advanced industries that will benefit our citizens for decades to come. With your concurrence, the Steering Committee will embark on a rigorous process with your Administration to craft an operational plan to meet our common goals.

We look forward to working with you on next steps to address and secure this important opportunity together.

Sincerely,

Chancellor Robert L. Caret, PhD University System of Maryland

President Ronald J. Daniels, JD, LLM Johns Hopkins University



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## Executive Summary

Historically, Maryland has been a leading hub in cyber security operations, as well life sciences research and discoveries. With more of our lives dependent on connectivity, and with the rise of the internet of things, cybersecurity has become a central feature in all products being developed and commercialized. The life sciences sectors (biotech, pharmaceuticals, medical devices, diagnostics and bioinformatics) are on the cusp of major change which is impacting how we view and treat disease. With both industries currently poised for significant growth, Maryland is positioning itself to build on its current leadership and capture the momentum of these innovation sectors. Governor Hogan announced on May 18, 2017 a new, comprehensive initiative to expand the state's leadership in cyber security and life sciences: **EXCEL MARYLAND**.

Excel Maryland will build on the state's current strengths in science, technology and innovation:

- Its unique concentration of the nation's leading organizations in cybersecurity public and private;
- Exceptional leadership and scientific talent at its world-class universities across the state;
- Unique resources in life sciences;
- Talented workforce; and
- Trends towards convergence between life sciences and cybersecurity, with Maryland already having developed significant assets in both sectors;

Excel Maryland is a bold, new statewide economic development initiative designed to accelerate innovation-driven commercial activity – with a special focus on the state's cybersecurity and life sciences industries. Under Governor Hogan's leadership, and in strategic partnership with the President of Johns Hopkins University and the Chancellor of the University System of Maryland, the strategic priorities for Excel Maryland were developed by a Steering Committee comprised of some of the state's top cyber and life sciences stakeholders – the CEO's of startups and established companies, public policy experts and leaders of Maryland's world-renowned colleges and universities.

To support the Steering Committee in developing key priorities and investment targets for Excel Maryland, Dr. Susan Windham Bannister, founding President and CEO of the Massachusetts Life Sciences Center, and Ms. Pamela Goldberg, immediate past President and CEO of the Massachusetts Technology Collaborative (MassTech) were engaged as consultants. Dr. Windham-Bannister and Ms. Goldberg played major roles in bringing Massachusetts to its current position of global leadership in life sciences and digital technology. Both leaders have direct, hands-on experience in formulating and executing strategies to accelerate the growth of innovation economies. The consultants were engaged for this project by the Maryland Economic Development Corporation (MEDCO), and the project was conducted under MEDCO's



auspices. The consultants' specific objectives were to diagnose Maryland's innovation capacity, shape the strategic priorities, determine where investments should be targeted, and recommend broad outlines of a strategy for Excel Maryland.

The consultant's analysis determined that Maryland's innovation capacity has accelerated but there still is work to be done. To establish itself as the leading industry cluster in both cybersecurity and life sciences, and to create a critical mass of companies and jobs in these sectors, Maryland must focus on the following key areas:

- 1. **Ecosystem**: better connectivity between the various stakeholders. This means growing a collaboration among institutions, government, and the private sector that is far stronger and more connected than in the past;
- 2. **Talent**: seasoned talent to support entrepreneurs as they build companies and to help raise money and build operations;
- 3. A Maryland "Innovation Story": a program to communicate a unified message about Maryland's assets and opportunities in growing cybersecurity and life sciences;
- 4. **Attractiveness to Capital**: building the innovation environment that is attractive to investors prepared to take high risk.

Maryland's cyber security and life sciences assets, if aggregated and supported by strong leadership from the public and private sectors and aggressive public policy and marketing initiatives, position the region for explosive growth. This is the moment for Maryland to move forward with an emboldened public-private initiative.



## INTRODUCTION

Governor Larry Hogan has declared that "Maryland is Open for Business!", and the state's economic data support the Governor's assertion. Maryland's economy is stronger than it has been for more than a decade. The unemployment rate stands at just 4.0 percent, falling below the national average, which currently stands at 4.3 percent. The state added 11,500 private sector jobs over the month of August, an increase that is more than *double* the national rate of job growth. Since January 2015, Maryland has added 110,800 jobs. To build on this momentum, Governor Hogan announced on May 18, 2017 a new, comprehensive, statewide economic development initiative to expand this growth: **EXCEL MARYLAND**.

#### What is Excel Maryland?

Excel Maryland is a bold, new statewide economic development initiative designed to accelerate innovation-driven commercial activity – with a special focus on the state's cybersecurity and life sciences industries. Under Governor Hogan's leadership, and in strategic partnership with the President of Johns Hopkins University and the Chancellor of the University System of Maryland, the strategic priorities for Excel Maryland were developed by a Steering Committee comprised of some of the state's top cyber and life sciences stakeholders – the CEO's of startups and established companies, public policy experts and leaders of Maryland's world-renowned colleges and universities. The list of Steering Committee members can be found in Appendix A of this report.

#### **Setting Strategic Priorities for Excel Maryland**

The consultants' specific objectives were to:

- Conduct a "diagnosis" of Maryland's baseline innovation capacity What are Maryland's current strengths? What is working well? What should be emphasized and grown to strengthen the Excel Maryland initiative and accelerate innovation in Maryland's cyber security and life sciences industries?
- Shape Excel Maryland's *strategic priorities* using insights from key stakeholders and the consultants' diagnostic where should the Excel Maryland initiative focus? What should be strengthened?
- Determine where *investments should be targeted* to make maximum impact in addressing these priorities -- Where do resources and investments need to be enhanced?
- Recommend the *broad outlines of a strategy* for Excel Maryland



The findings and observations presented in this report are based on a review of secondary data and conversations with **215 stakeholders** -- *within and outside Maryland*. The conversations with stakeholders were conducted as open-ended discussions using topic guides as opposed to structured survey questionnaires. The high level of stakeholder participation in the study:

- Enables both quantitative and qualitative analysis;
- Supports a robust set of findings and a high level of confidence in the conclusions presented;
- Reflects a high level of engagement and enthusiasm among stakeholders for Excel Maryland; and
- Provides strong direction and clarity regarding the most important priorities for Excel Maryland from its inception.

It is important to note that the strengths and weaknesses in Maryland's innovation capacity and ecosystem have grown organically over decades, as business and academic communities have developed around the cyber security and life sciences sectors. To that end, this report focuses on the relative best opportunities for the Excel Maryland initiative -- through coordination and collaboration between the state's business, academic, and governmental communities -- to maintain and grow the state's strengths, as well as address any weaknesses that have evolved over time.

This report is submitted under the auspices of MEDCO and on behalf of the Steering Committee. It presents the observations and findings from the consultants' diagnosis of the innovation ecosystem in Maryland – particularly as it pertains to life sciences and cyber security, the two top growth industries in the state – and the implications of the diagnostic observations for Excel Maryland. This report is intended to "inform" the launch of Excel Maryland and support policy formulation. The Steering Committee hopes that the report will contribute to Excel Maryland's success in making the best and most efficient use of public resources, enhance the state's leadership in cybersecurity and life sciences innovation, generate jobs for Maryland residents, attract investment capital, produce additional tax revenue, and drive economic development.



## BUILDING ON MARYLAND'S CURRENT STRENGTHS

The consultants' analysis makes it clear that *the Excel Maryland initiative is building on a strong foundation*. Maryland has world-class resources and talent, a growing pool of start-up companies, several Fortune 500 companies that call the state home, a strategic location, the hub of U.S. cyber operations, and a history of success in break-through science and technology.

## MARYLAND ALREADY RANKS HIGH -- AND HAS MOVED UP -- AMONG U.S. STATES ON THE BLOOMBERG INNOVATION INDEX:

#### Figure 1

#### Bloomberg 2016 U.S. State Innovation Index

Maryland moves into top five as Connecticut gets pushed to seventh Utah makes most significant jump with a six spot move to 14



Sources: Bloomberg, Bureau of Economic Analysis, Bureau of Labor Statistics, National Science Foundation, StatsAmerica.org, U.S. Census, U.S. Patent and Trademark Office

Bloomberg 💵



#### Table 1

## Bloomberg 2016 U.S. State Innovation Index

2016 rank	2015 rank	Change	State	Total score	R&D intensity	Productivity	Tech company density	STEM concentration	Science & engineering degree holders	Patent activity
1	1		Massachusetts	94.82	2	5	4	3	5	2
2	2		California	93.80	4	7	3	6	3	1
3	3		Washington	92.73	5	9	7	1	2	3
4	4		New Jersey	80.17	12	10	5	15	10	12
5	7	+2	Maryland	78.95	3	13	19	2	4	26
6	6		Oregon	78.22	9	15	22	9	6	8
7	5	-2	Connecticut	78.17	8	4	24	12	12	7
8	8		Colorado	75.58	22	17	16	5	7	10
9	10	+1	Minnesota	75.00	15	19	10	8	23	4
10	12	+2	New Hampshire	74.75	10	39	2	14	9	6
11	11		Virginia	73.23	20	16	14	4	1	29
12	9	-3	Delaware	69.80	7	3	34	11	17	16
13	13		New Mexico	68.90	1	23	8	18	15	31
14	20	+6	Utah	63.50	14	34	12	13	28	13
15	19	+4	Arizona	62.80	16	42	6	10	24	17
16	14	-2	Rhode Island	62.55	18	26	1	25	21	24
17	16	-1	North Carolina	62.37	17	24	13	23	19	20

Note: **R&D intensity:** Research and development spending, % state GDP (GSP). **Productivity:** GSP per employed person (12-month average employment). **Tech company density:** Number of highly technologically intensive public companies --- in industries such as aerospace and defense, biotechnology, large pharmaceutical, hardware, software, semiconductors, Internet software and services, and renewable energy -- domiciled in each state, as % total publicly listed companies domiciled in the state. Included: states with at least five public hi-tech firms; companies actively trading as of 12'2016. **STEM concentration:** Science, Technology, Engineering and Mathematics (STEM) professionals, % state total employed. **Science & engineering degree holders:** as % state 25+ degreed population. **Patent activity:** Utility patents (patents for invention) granted by the state of origin, per million of state population All metrics equally weighted. Most recent available data used.

Sources: Bloomberg, Bureau of Economic Analysis, Bureau of Labor Statistics,

National Science Foundation, StatsAmerica.org, U.S. Census, U.S. Patent and Trademark Office

Bloomberg 💵

The Bloomberg U.S. Innovation Index scored each of the 50 states on a 0-100 scale across six equally weighted metrics: R&D intensity; productivity; high-tech density; concentration of science, technology, engineering and mathematics (STEM) employment; science and engineering degree holders; and patent activity.

The summary of the Bloomberg analysis does not comment specifically on Maryland, but the authors, Michelle Jamrisko and Wei Lu, do provide insights into the strengths that led to the rankings of a few states.

According to the report the "secret sauce" for Massachusetts' high ranking is its "potent mix" of tax incentives to draw in companies, research partnerships between its big-name universities and local businesses, and the transfer of much of that research into patent-able products and start-up companies. While Silicon Valley lays claim to innovative powerhouses such as Apple Inc. — still the world's most valuable company — density in the Bloomberg index is measured by number of companies rather than market capital, and Massachusetts scored more highly than California using this criterion. General Electric Co.'s announcement earlier this year that it would move its headquarters to Boston amid rancor over tax increases in Connecticut was cited to illustrate how Massachusetts widened its lead in the 2016 Bloomberg rankings. "The state government's trying to really be actively engaged in recruiting companies directly, actively, and smartly." GE Chief Executive Officer Jeffrey Immelt hailed the Boston area's investment in research and development in a January statement on the move, complementing the city's "diverse, technologically-fluent workforce."

Utah was singled out as a standout in the 2016 rankings, by climbing six spots to No. 14, the biggest gain of any state. The authors of the Bloomberg analysis credit Utah's jump to a surge in R&D spending. They also point to the state's emphasis on linking education, government and the private sector is starting to pay more dividends for "Silicon Slopes — Silicon Valley with better skiing," said Val Hale, executive director in the Utah Governor's Office of Economic Development. Ms. Hale credits higher-education institutions such as Brigham Young University with embarking on ambitious research programs, including for cancer treatment. But the state also has focused on earlier stages in the education ladder by setting up internships for high school students at aerospace industry firms such as Boeing Co., which can earn the strongest candidates full-time jobs and even tuition reimbursement.



## MARYLAND HAS A HIGHLY-EDUCATED WORKFORCE:

Maryland is the fourth leading state in the nation in concentration of technology jobs (8.6% of private sector workforce). The state has one of the best K-12 public school systems and is second in the nation in student Advanced Placement exams. Within the state there are fifty-seven accredited 2 & 4-year colleges & universities – many with specialized biotech programs and cybersecurity training. Additionally, there are sixteen community colleges with many offering continuing education and workforce training in biotech and cyber security. One of Maryland's outstanding features is that it has the highest concentration of employed doctoral scientists and engineers in the U.S.



#### MARYLAND HAS UNIQUE RESOURCES TO SUPPORT INNOVATION:

- The iCyberCenter@bwtech at UMBC Research and Technology Park is Maryland's first university affiliated research park. Governor Hogan announced plans for the iCyberCenter@bwtech as a collaboration of UMBC and the Maryland Department of Commerce to support companies from other nations as they establish themselves in the United States, using Maryland as their US headquarters. The Center offers an intensive training program for the executives of select international companies seeking to connect with the U.S. market. The program's initial partnership is with the United Kingdom. The bwtech park at UMBC is home to more than 130 cyber and bio/life science companies, some of which are housed in the Northrop Grumman Cync Incubator.
- The Applied Physics Laboratory (APL) at Johns Hopkins University. For more than 70 years, (APL) has provided significant contributions to critical challenges with systems engineering and integration, technology research and development, and analysis. APL's scientists, engineers, and analysts serve as trusted advisors and technical experts to the government, ensuring the reliability of complex technologies that safeguard the nation's security and advance the frontiers of space. APL also maintains independent research and development programs that pioneer and explore emerging technologies and concepts to address future national priorities. It is a globally respected research facility.
- The National Institute of Standards and Technology (NIST), headquartered in Gaithersburg, is the oldest federal laboratory and has conducted cyber security research for more than three decades. As the government lead in standards development and protocols for cyber security operations, testing and certification, NIST is involved in basic R&D, application development, implementation and technology. The agency works with the National Science Foundation and the National Academy of Sciences, offering a testing laboratory for cyber products on a fee-for-service basis.
- The National Cybersecurity Center of Excellence (NCCOE), a part of the National Institute of Standards and Technology (NIST), is a collaborative hub where industry organizations, government agencies, and academic institutions work together to address businesses' most pressing cybersecurity challenges. This public-private partnership enables the creation of practical cybersecurity solutions for specific industries or broad, cross-sector technology challenges. Working with technology partners—from Fortune 50 market leaders to smaller companies specializing in IT security— the NCCOE develops modular, easily adaptable example cybersecurity solutions demonstrating how to apply standards and best practices using commercially available technology. The NCCOE documents these example solutions in the NIST Special Publication 1800 series, which maps capabilities to the NIST Cyber Security Framework and details the steps needed for another entity to recreate the example solution. The NCCOE is a \$5 billion FFRDC collaboration between NIST, MITRE Corporation and the USM.



- The National Institute for Innovation in Manufacture of Biopharmaceuticals (NIIMBL) The NIIMBL is a private-partnership developing innovative approaches to accelerate medical progress by fostering technology development, best practices and standards that bolster biopharmaceutical manufacturing innovation The NIIMBL mission is to accelerate biopharmaceutical manufacturing innovation, support the development of standards that enable more efficient and rapid manufacturing capabilities, and educate and train a worldleading biopharmaceutical manufacturing workforce, fundamentally advancing U.S. competitiveness in this industry. The University System of Maryland and John Hopkins University are part of a national consortium working with The National Institute of Standards and Technology (NIST).
- The Intelligence Advanced Research Projects Activity (IARPA). The nation's headquarters for advanced intelligence research, IARPA develops groundbreaking technologies for the intelligence community. Founded in 2007, IARPA is headquartered at University of Maryland at College Park and convenes government, academia, and the private sector to improve national security. IARPA consolidates NSA's Disruptive Technology Office, the CIA's Intelligence Technology Innovation Center and the National Geospatial-Intelligence Agency's National Technology Alliance.
- The Maryland Cybersecurity Center (MC2), created in late 2010, is an academic center on the University of Maryland campus that brings together faculty, researchers, and students working in the field of cybersecurity from several schools and departments across the university. MC2 is unique in its comprehensive, interdisciplinary approach to cybersecurity, in that it brings together not only faculty with expertise in the core areas of computer science and electrical engineering but also those with backgrounds in economics, social sciences, human-computer interaction, and other areas of engineering. The center has strengths in cryptography, programming-language and software security, behavioral aspects of security, empirical security, and cybersecurity economics. MC2 is part of the new 400+- acre University of Maryland, Greater College Park Discovery District, a major real estate redevelopment project incorporating research, innovation and co-working space amidst residential, retail, hospitality and entertainment related amenities designed to retain and attract students, research faculty, entrepreneurs and investors.
- The US Army Cyber Command at Fort George G. Meade was established shortly after the 2005 Base Realignment and Closure (BRAC). The United States Army Cyber Command directs and conducts integrated electronic warfare, information and cyberspace operations and is an important component of Maryland's cyber community.



## MARYLAND IS STRATEGICALLY LOCATED:



- Four nearby international airports enable travel to the rest of the U.S. market; as well as travel to Europe in six hours or less.
- For defense contractors, technology companies, and researchers in cyber security:
  - 50 federal agencies and research facilities are in central Maryland
  - Home to the National Security Agency (NSA)
  - A separate power grid makes Maryland an ideal location for secure back-office operations
  - The State has a fiber-rich, redundant and reliable telecommunication network valued at \$5.5 billion that support cyber security activities
- For life sciences companies and researchers:
  - One of the nation's largest life sciences clusters, strategically located halfway between two other major life science hubs: Boston and Raleigh/Durham
  - Generous (50%) biotechnology investor incentive tax credit



- Maryland's Life Sciences Advisory Board supports the state's biotech and health IT industry sectors
- Numerous incubators, accelerators, tech transfer funding programs, and other resources
- Home to dozens of federal agencies responsible for setting standards, approving products for sale to the U.S. market, conducting and/or funding cutting-edge research in human and animal health
- Proximity to the two most important federal agencies in healthcare and life sciences innovation -- the National Institutes of Health (NIH) and the U.S. Food and Drug Administration (FDA)
- Proximity to other key organizations such as the Frederick National Lab for Cancer Research, USAMRIID, ECBC, Walter Reed and US Pharmacopeia Convention (USP)
- Within a two-hour drive is access to 80% of the U.S. pharmaceutical industry and more than 2,200 life sciences companies



## MARYLAND HAS A SIGNIFICANT BIOSCIENCES PRESENCE:

Life Sciences in Maryland "By the Numbers"



Marylanders are fond of saying that "biotech discoveries are in our DNA." Among many achievements, the state can boast about being the first to map the human genome, developing the first rapid test for Ebola and producing the first FDA-approved blood test for colon cancer. Life sciences entrepreneurs as well as global leaders in the life sciences are thriving in Maryland. The state leads the world in adult stem cell production and vaccine development and represents one of the largest life sciences clusters in the U.S. with 500+ biotech firms, 2,360 life sciences companies, and world-class academic institutions such as Johns Hopkins University and the University of Maryland. Many of these experts are represented on the Maryland Life Sciences Advisory Board (LSAB), a key leadership group that supports the growth of the state's biotechnology sectors.

Home to research-intense federal institutes and centers, and universities, Greater Baltimore is one of the world's hubs for medical research and discovery. Johns Hopkins University and the University of Maryland, Baltimore have been attracting billions of dollars in annual research funding, with Johns Hopkins consistently raking as the top NIH-funded university in the U.S. The Baltimore/Washington region ranks 6th in biotech venture capital funding since 2008.

The Baltimore/Washington region also ranks 2nd nationally in concentration of biohealth professionals, with 85 percent of the companies and activities within Maryland. More than 2,500 biological and science degrees are awarded annually in the region. Overall, the Northeast Corridor leads the nation in employment in the biosciences sectors.

*The University of Maryland BioPark* has spent nearly a decade developing a community of science on Baltimore's Westside. The billion-dollar project covers 10 acres (12 acres at full build out) and 1.8 million square feet of office and laboratory space. Just minutes from the Baltimore



Convention Center and the Inner Harbor, the BioPark provides additional meeting space and facilities for convention and meeting groups. The \$86 million bwtech@UMBC Research & Technology Park in nearby Baltimore County includes 350,000 square feet of space on a 71-acre campus (North and South Campuses combined).

In 2006, East Baltimore has welcomed the opening of Johns Hopkins biopark known as the *Science + Technology Park*. This billion-dollar project features 1.1 million square feet of office and lab space spanning 31 acres. The biopark recently opened 17,000 square feet of dedicated innovation space for newly formed tech and biotech companies.

The number of government agencies in the region also has led to a high concentration of governmental contracting firms, including healthcare information technology (IT). The Baltimore-Washington Corridor is the strongest IT market in the U.S., ranking higher in IT employment concentration than areas such as the Silicon Valley and Boston. The large percentage of IT employment in the region is due in part to premier programs at many Maryland and Greater Baltimore colleges and universities. Eight Greater Baltimore colleges and universities are recognized as NSA Information Assurance Centers of Excellence, and the University of Maryland Baltimore County has the second highest percentage of graduates in the STEM fields of all state universities. Forbes has named Baltimore one of the nation's top five best cities for tech jobs, with a nearly 40 percent growth in employment in the industry since 2001.



## MARYLAND'S FIRSTS IN LIFE SCIENCE INNOVATION:

- First to map human genome
- Leader in personalized medicine
- 20% of top influencers worldwide in vaccine development
- First FDA approved mobile telephone application
- World's largest producer of adult stem cells
- Only FDA approved data center
- First FDA approved wireless device
- First rapid test for Ebola to be approved by the FDA, EUA and WHO

## MARYLAND HAS AN EVEN GREATER FOOTPRINT IN CYBER SECURITY:

Cyber Security in Maryland "By the Numbers"

Employment (2016) 115,550





Total Wages (2016) \$12.42B



As a leading knowledge-driven economy, Maryland has a critical mass of federal agencies, academic institutions, information technology companies and individuals with the skills needed to secure the nation's infrastructure and commerce. Maryland's federal agencies are key leaders in the country's cyber security strategy. Technology companies in Maryland are conducting many activities to provide and improve information security - collecting and analyzing data to improve intelligence and alert users to threats. In addition, these companies are developing new technologies and using advanced encryption methods to enhance the security of government communications. In total, Maryland's superior security industry cluster, talented human capital, and dedicated infrastructure assets position the state at the epicenter of national cyber security leadership.

The presence of the NIST, NSA, IARPA and DISA, along with the Federal Bureau of Investigation (FBI) and the Central Intelligence Agency (CIA) puts Maryland in a position of federal preeminence in cyber security research and development. The work of these organizations is complemented by cyber security activities in other major Maryland-based federal agencies and military installations. The National Security Agency (NSA) at Fort Meade conducts research in computer system, data analytics, network, and cyber security for national security. NSA is focused on cyber security policy, architecture, research and development, applications development, implementation, technology assessment, testing and standards.

- NSA funds basic and applied research at colleges and universities in Maryland and across the country, including University of Maryland College Park (UMCP), University of Maryland Baltimore County and Johns Hopkins University
- Defense Information Systems Agency (DISA), which is the technical implementation arm for the Department of Defense (DoD), provides advanced information technology and



immediate communications support. As a combat support agency, it plays a vital role in delivering information technology services and capabilities to the war fighter. The agency's mission touches all facets of the DoD information technology environment. DISA moved from Virginia to Fort Meade in 2011 and brought approximately 4,300 advanced technology jobs to Maryland.

Just recently, Cybersecurity Ventures list of the "Cybersecurity 500" included *12 Maryland cyber companies* as being among the "world's hottest and most innovative companies in the cybersecurity industry ("Cybersecurity 500," Cybersecurity Ventures, Q2 2017):

- Lockheed Martin
- Northrop Grumman
- Tenable Network Security
- Arxam
- ZeroFOX
- KEYW
- IronNet Cybersecurity
- Protenus
- TrustedKnight
- Sonatype
- RedOwl
- Saint Corporation



## DRAWING ON LESSONS FROM "SUCCESS STORIES" IN OTHER GEOGRAPHIES

The architects of Excel Maryland are committed to developing a strategy for implementing Excel Maryland that reflects the state's unique strengths as well its unique challenges. However, to support the development of Maryland's growth strategy, the consultants' diagnostic assessment and recommendations incorporate useful "lessons learned" from other successful initiatives with goals and aspirations like those of Excel Maryland. A review of selected initiatives is not included in the body of this report but can be found in an Appendix E.



## **DEVELOPING STRATEGIC PRIORITIES FOR EXCEL MARYLAND**

The remainder of this report addresses strategic priorities for Excel Maryland that will build on the state's current strengths in cybersecurity and life science. The analysis addresses several key questions: Where should the Excel Maryland initiative focus to leverage the state's strengths? How can the state's baseline innovation capacity be further improved? What are the implications for Excel Maryland's priorities?

Illustrative quotes – presented without attribution -- are interspersed throughout the text to elucidate on the perspectives that were provided by the stakeholders who participated in the study and to bring the story "to life."

As noted earlier, the consultants recognize that the strengths and weaknesses of Maryland's innovation ecosystem have developed organically over time. Our diagnostic assessment must be considered as a "baseline" that has evolved and has an historical context that is not attributable to any single business, academic or government entity.

#### How was the Assessment Conducted?

To develop input to the formulation of strategic priorities, the consultants conducted an assessment based on conversations with **215 stakeholders** -- *within and outside Maryland*. A list of the categories of study participants is included as Appendix B to this report.

The figure below presents the distribution of study participants by stakeholder group:



#### Figure 2: Study Participants by Stakeholder Group

The data was collected using a combination of in-person and telephone 1:1 interviews, and roundtables with groups of 3-15 participants. The figure below presents the distribution of participants by data collection method:



## Figure 3: Study Participants by Data Collection Methodology

After their interviews and roundtable discussions were completed, just under 100 Maryland stakeholders completed a self-administered exercise to identify, rank order, and weight (by allocating 100 points) priorities for Excel Maryland. A copy of this exercise is included as Appendix C to this report.

Data from the interviews were synthesized by the consultants and:

- Analyzed using an "innovation capacity framework"
- Compared with studies of other innovation hubs and best practices



#### **The Diagnostic Framework: Innovation Capacity**

The consultants' assessment was conducted using an "innovation capacity" framework, shown in the figure below:

#### Figure 4: Innovation Capacity Framework

### What is Innovation Capacity?

"The ability to produce and commercialize a flow of innovative technology, products and services over the long term."

Furman, Porter and Stern (2002)



"Geographies with high *innovative capacity* usually develop faster economically, attract highly skilled populations, and experience rising incomes and trade." (Harvard Business School 2011)

Proprietary of Biomedical Growth Strategies

Innovation is a process and has a lifecycle. Whether it's cyber security, life sciences, digital technology, or defense the innovation lifecycle includes "discovery" or creation, development, growth, and finally, maturity and sustainability. Products and services in digital technology-related sectors may move across these stages more quickly than, for example, products and services in pharmaceuticals and biotechnology. However, if there are major gaps in the supporting platform that enables innovation to move across its lifecycle in any sector, then the process stalls, moves to a geography where it can find the enablers that it needs to progress or, worst of all, may never start at all.

## The major goal of Excel Maryland is to "make Maryland the best place for innovation to take place" – be it innovation in cybersecurity, life sciences or other industry growth sectors.

This means having high innovation capacity – being a state where all of the enablers that support innovation can be found. By strengthening the state's current resources and filling in existing gaps, Excel Maryland will make Maryland an even stronger place where new companies



start, grow and thrive, and where mature companies that rely on innovation want to have a significant presence.

To conduct a diagnostic of Maryland's innovation capacity, the consultants analyzed the state on five key "enablers" of innovation:



The "enablers" of innovation capacity are interactive – each enabler affects the performance of others along the innovation life cycle

One of the most important enablers of innovaton capacity is the *presence and strength of an "innovation ecosystem."* Innovation leaders often confuse a "cluster" with an "ecosystem" -- but the physical presence of the resources and institutions required for innovation (a cluster) does not mean that they are working well together to support the translation of new science and technologies into commercialization. The different components must come together for growth of innovation capacity to be successful.



## Figure 6: A "Cluster" or an "Ecosystem?"

A "cluster" is a collection of assets – universities, medical centers, companies, investors, service providers, etc.

In an innovation "ecosystem" there is a high degree of connectedness - all members of the cluster work well together!





#### **Ecosystem Assessment**

There are indicators that can be used to assess whether an ecosystem exists and, if so, how strongly it is coalesced. These are shown in the figure below, and were the focus of the consultants' assessment:

# Five "A's" of Ecosystem Creation and Effectiveness **H**(C

Figure 7: Assessing an Ecosystem



Proprietary of Biomedical Growth Strategies



## What Did the Diagnostic Assessment Show?

The consultant's assessment of Maryland's Innovation Capacity identified that Maryland has a few important gaps in the enablers of innovation capacity. These gaps create challenges for the state in gaining the maximum leverage on its many strengths and resources.



## LOOSELY COALESCED ECOSYSTEM

The enablers of innovation **are not meshing well in Maryland**, making it difficult to get traction and leverage on the many activities and investments that are underway across the state.



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The key findings regarding the individual enablers of a well- coalesced ecosystem are summarized below:



- Historically, no overarching and well-articulate vision that coalesces the innovation activities and strengths across Maryland
- Many participants in the study were unclear about the goals of Excel Maryland and thought more in terms of their own "silos" or areas of interest than as "we"



Advocacy and Publicity Strategy

- Stakeholders could not point to a single entity that advocates for innovation in Maryland – either statewide or by industry sector – and "owns" the responsibility for publicizing it
- Stakeholders agree that Maryland needs a specific "innovation story" that is consistently told and actively marketed – many were "not sure" when asked what the current messages are
- Communications will need to be a key element of Excel Maryland both within and outside the state



- Pockets of support, coaching and mentoring, but not coalesced "micro" systems
- High volume of activity in MD, but much of it is opportunistic and localized and not well-integrated into organized "mentoring" networks
- In the aggregate, it is quite possible that MD currently invests \$1B+ in innovation-related activities, but these investments be presented about it as a coordinated investment with clear goals
- Geography is a challenge tendency is for everyone to see themselves as a "tub on its own bottom" and to focus on more localized
- Advisory and mentoring resources exist at the county level these should be reinforced and coalesced to create critical mass





Alignment of Core Competence and Value Proposition with Stakeholders

- The value proposition for actively participating and investing in a Maryland innovation ecosystem is not well-articulated. Industry, academic and government partnerships are created based on individual needs and interests ("one-offs"), but are not coalesced to build the state's innovation capacity
- Individual activates are not "aligned" with an overall strategy to build innovation capacity across the state
- All stakeholders frequently mentioned the need for increased, sustained partnership at all levels – academic, industry and public sector



Attraction of Ecosystem – what are the incentives?

- Competition across counties and between MD and VA has fragmented what could be a regional ecosystem if coalesced
- There does not appear to be a set of performance and impact metrics that
  - Provide a basis for monitoring and measuring the "success" of innovation initiatives
  - Supports a strong business case for building and being part of an innovation ecosystem ("what are the incentives?")
  - Demonstrates the compelling reason for stronger linkages among the academic institutions, investors, policy-makers, industry leaders and other stakeholders to transform the cluster into an "ecosystem"
- There isn't a clear understanding of the "value exchange" that each stakeholder would receive from these partnerships



## What are the "Consequences" and "Opportunity Costs" for Maryland of an Ecosystem that is Loosely Coalesced?

When the organizations and resources that are present in a cluster do not work as a system, the innovation lifecycle suffers. A good analogy is the drivetrain of a motor vehicle: if the group of gears and components that deliver power to the drive train don't mesh (well), there will be no (significant) forward progress.

The consultants' assessment found several ways in which Maryland's loosely coalesced innovation ecosystem sub-optimizes the potential for innovation in the state, despite its many current strengths and resources:

- Leverage on resources, investments and current strengths Disaggregation of activities and investments that support innovation reduces and sub-optimizes the leverage on the state's resources, investments and current strengths
- Access Hard for entrepreneurs to identify and access the pool of seasoned talent and investors who can serve as mentors, advisors and coaches
  - Greater access to coaching, mentoring and support would increase the overall "odds" of success for start-ups
- Business culture Generally "risk averse;" limited vs. broad entrepreneurial culture
  - States with vibrant innovation economies have morphed and blended their business cultures to incorporate the different business models of their legacy industries and their innovation sectors
  - The number of people employed either directly or indirectly in government jobs limits the focus on entrepreneurship and innovation
- Integration Difficult for new market entrants to gain traction -- cannot easily connect and become part of an innovation community
  - "We need more villages to help guide start-up teams people who bring value other than capital. This support needs to be systemized. More of these networks exist outside of Maryland so there is a flight risk for our new companies." (Academic Entrepreneur)
  - "I think that we have pockets of entrepreneurial culture but it's not really widespread. We haven't generated a broad level of excitement about starting new companies and taking risk." (Industry Executive)
  - "We need more engagement between the legacy businesses and those of us at the other end of the business and investment continuum. If you aren't lucky enough to get plugged in you don't know how to access them." (Entrepreneur)



Historically, there has been no identifiable, overarching strategy that provides an organizing framework for integrating the many strengths, investments and resources in Maryland that support technology innovation. The activities and investments underway are highly fragmented at all levels and **need to be better coordinated and coalesced**.

- **"Patchwork approach"** where organizations and funding sources are investing to address gaps but most activities are narrowly targeted, not at scale, and not coordinated
- "Micro ecosystems" have organized and are investing around specific issues, opportunities, firms, counties, etc. but linkages across these ecosystems are not strong and sometimes are in competition
- **Relatively limited critical mass**; existing resources are geographically dispersed and not targeted or coordinated
- No "single point of contact" for technology innovation across the state in the form of an organization or entity
- Impact Metrics are undefined making it difficult to document progress and improvements.

"Our efforts have been so fragmented that we really can't answer three key question: what have we been doing in the aggregate about what's wrong, how much have we invested and what progress have we made?" (Academic Administrator)



## **"ATTRACTIVENESS" TO CAPITAL**

The gaps in Maryland's innovation capacity make the state relatively less "attractive to capital" than other geographies that are innovation "hubs." This explains why more venture capital is not available to start-ups in the state. In Maryland, *the lack of executive level talent for startup companies is a key factor that explains why venture capital is not more readily available.* 

### What makes Maryland less "attractive to capital?" than competing innovation hubs?

- Limited capital for leverage and syndication ("A" Rounds and beyond)
- Small pool of executive-level and operations talent with experience in growing young companies
- Workforce has less exposure to career paths that involve working in start-up ("risky") ventures
- Poorly coalesced ecosystem/ innovation community
- Few business accelerating spaces (as compared to incubators)
- Culture of entrepreneurship
- Efficiency of tech transfer
- Volume of deal flow/tech transfer
- Poorly coalesced venture mentoring network and support system
- Quality of deal flow
- Lack of a strong angel community

"Capital finds the maximum return – it has no friends" (Serial Entrepreneur)


**Observations from Stakeholders** 

- "I was in a conversation with a graduate student, encouraging them to think about entrepreneurship vs. an academic career and then another faculty member standing right next to me said to that student – 'you don't' want to go over to the dark side.'" (Academic Entrepreneur)
- "Money is going to follow the growth. There are plenty of startups but there isn't the infrastructure, the know-how to build a company from a start-up to a larger entity, or the sense of community that will be attractive to investors who want to put in more money" (Cyber Entrepreneur)
- "We could have taken VC money but the investor would have made us move to CA. There
  wasn't enough (of a support system) here to make them comfortable that we overcome
  major roadblocks." (Biotech Entrepreneur)

Observations from Investors

- "We back people, and talent is the biggest gap here in Maryland there just aren't many people that we want to back. I'd like nothing better than doing more investing here and spending less time on airplanes." (Maryland VC)
- "Their universities do spin out new companies but the volume isn't high enough to keep (the state) on our radar screen, especially relative to other places where we can put capital to work -- and there are stronger competitors for our attention." (VC outside Maryland)
- "Maryland is an under-ventured market and this is where our firm focuses. We help pull technology out of a university and co-found companies. But we're small and can only have so many companies in our portfolio." (Maryland VC)
- "Although there have been definite improvements, there isn't enough tech transfer underway here. This impacts the perception of Baltimore. Also, there isn't a spirit of collaboration or desire to provide access to the new technology. And of course, there are a lot of politics. "(Maryland VC)
- "You don't open an office where there isn't enough volume of deal flow." (VC Advisor outside of Maryland)



Investors frequently mention that they pay special attention to innovation hubs with a high volume of start-ups and university spin outs because these provide "more shots on goal." The table below shows the volume of start-up companies "spinning out" of academic institutions in in geographies that are – or are becoming considered as – high performing innovation hubs.

#### Table 2

Fiscal Year	JHU	UMB	UMCP	UMBC	USM*	COLUMBIA	STANFORD	МІТ	HARVARD	U PITT	CARNEGIE MELLON
2016	22	10	10	6	26	21	27	25	13	13	8
2015	16	5	5	2	12	27	28	28	14	11	11
2014	13	3	5	0	8	9	23	20	10	6	10
2013	8	5	5	2	12	14	9	14	9	9	12
2012	8	3	5	0	8	15	17	16	10	9	10
2011	11	3	8	3	14	15	8	25	9	2	10
2010	11	3	4	0	7	12	10	17	8	6	10
2009	10	3	2	1	6	13	9	18	8	3	10
2008	12	2	2	4	8	10	9	20	12	3	10
2007	4	4	3		7	12	6	24	6	8	8
2006	6	2	3		5	?	7	23	3	5	12

#### Number of Startups (AUTM Definition<sup>1</sup>) 2006-2016

<sup>1</sup> AUTM is the Association of University Technology Managers (autm.net) and defines an academic start up as a start-up where a license to the university IP is part of the creation of the company. This AUTM definition excludes other types of university start-ups, such as student-led ventures or activity outside of University's tech transfer and intellectual property offices.

\*USM (University System of Maryland), this column includes the total of UMB (University of Maryland, Baltimore), UMCP (University of Maryland, College Park) and UMBC (University of Maryland, Baltimore County) startups.



#### **Growth Capital**

Many stakeholders assert that Maryland has adequate seed capital for start-ups but a significant gap in the availability of Series "A" funding and beyond. They frequently point to State programs, especially those offered by TEDCO, that appear to be meeting current demand for early stage funding. Maryland entrepreneurs also appear to have a high rate of success in accessing federal Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants. Academic institutions also are making funds available for start-ups created by faculty and students but the challenge is for later rounds of funding.

- "The opportunity that we're missing is in significant investment after the seed rounds. So, the gap begins around the Series "A" round and continues. Companies have had to look to VCs outside the state to raise capital and are then recruited out of the state to receive those funds" (Serial Entrepreneur)
- "There ARE serial entrepreneurs in Maryland but not many because they can't access capital to be able to scale. We need a critical mass of risk capital for companies that are in growth mode. This is where investors often want to syndicate. A fund that could be leveraged for this purpose would be good." (Investor)
- "There is a lot of early stage money but nobody is thinking about what comes next. We're focused on the very early stage activities but then what? There is a cliff." (Maryland VC)



#### **Executive Level Talent**

The founders of young companies in Maryland need access to seasoned talent with experience in commercialization and raising capital. Entrepreneurs in both the cyber and life sciences sectors report that it is very difficult for them to find this type of talent in Maryland This often is a source of pressure from investors to move the companies to geographies where this talent is more readily available. Entrepreneurs also often struggle to find entry and mid-level workers who are willing to work in early stage ("risky") companies. Part of this risk aversion is attributable to concerns about "lack of other options" if start-ups fail. It is difficult to transfer the skills, experiences and "mindset" from academia and government to entrepreneurial environments, so workers in government and academia often are not good candidates for startups. Entrepreneurs report that they are willing to train entry level staff to work in commercial settings, but would welcome it if academic institutions would provide students with exposure to courses on entrepreneurship, even for STEM majors.

Several entrepreneurs and Venture Capitalists (VC) "import" senior level talent from Pennsylvania or New York (i.e., these executives commute several times per week). This is clearly not viable as a long-term solution for the startup community.

- "Among the NIH, Hopkins and the UMS there are spin outs, but we don't see the "C" level talent to take them forward beyond the science and technology. We (VCs) invest in people, so no matter how great the technology is, we look at the team who takes it forward do they understand the path to commercialization? Can they raise the next round of funding?." (Maryland VC)
- "Our CEO comes in several days a week from Philadelphia. The train system in the corridor makes it possible for us to draw on 'C-level' talent from Philadelphia and New York but it's a short-term fix." (Entrepreneur)
- "We've had a hard time finding 'C-level' talent willing to move to Baltimore." (Entrepreneur)



#### Workforce

There are *more commonalities than differences in workforce gaps* for start-up companies in life sciences and cybersecurity sectors. Cyber companies express greater concern about the pace of workforce creation for their industry, as there currently are thousands of unfilled positions requiring cyber skills. The pipeline of scientific and technical talent in the life sciences is not as significant an issue. Stakeholders in *both* sectors emphasize the need to maintain a strong pipeline of prospective employees with the right skills to sustain the state's appeal to both larger companies and smaller companies. This would be enabled by *further strengthening partnerships between industry and academia* to make sure that the skills training that exists matches workforce needs. As noted above, workers in the life sciences would be even more "employment ready" if curriculum included some business courses.

Stakeholders feel that *more needs to be done to accelerate the pipeline of workers, especially in cyber – and that greater coordination is needed*. But they acknowledge activities that currently are underway to address the issues of supply and skill mix. For example, the USM has significantly increased its number of cyber graduates and has forged productive working relationships with companies like Lockheed Martin and Northrop Grumman. Recent Business Higher Ed Forum case studies attest to USM's role in preparing high school students (ACES Program) supplying top talent. Current skills gaps are being addressed via certification programs such as those offered by UMBC Training Centers (e.g., Rx5 program) and University of Maryland University College via online programming.

Recent data from the University of Maryland System reflect its efforts to build the pipeline of STEM workers:

- STEM Enrollment = 35,700+ (61% increase since 2010)
- STEM Degrees awarded = 9,500+ (67% increase since 2010)
  - 3,470 cyber degrees (107% increase)
  - 5,270 bio/health degrees (40% increase)

Maryland's community colleges have also been active in establishing cyber pathways training programs.

- "The brain drain on the state is not students and recent grads, but the founders of young companies-- who have the potential to be mentors going forward." (Industry Executive)
- "We have plenty of talent and pipeline but not sure that they are aligned. You have people looking for work but their skills don't match what industry needs. The state does a lot to promote pipeline but not enough to develop a workforce that has the right skills. Engagement between industry and academia doesn't mean one offs – a work fair, a forum. We need relationships that are ongoing...constant engagement between business and academia." (Business Executive, Workforce Development Board)



#### **PROXIMITY TO FEDERAL GOVERNMENT**

Proximity to Federal Agencies is both a strength and a weakness, as shown in the Figure below.

#### **Figure 8: Impact of Federal Agencies on Maryland's Innovation Capacity**

- Large client for cyber and life sciences
- Important source of new science and technology
- NSA, NIH. NIST and APL have been important sources of new company spinouts
- Many cyber companies want access to NSA
- Major talent pool with content and technical expertise for mature and start-up companies
- Life sciences companies want access to the FDA

- Infuses risk aversion into the business culture
- Conflict of interest policies in government impedes access to a vast source of new science and technology for commercialization
- · Competes with private sector for talent
- Government talent pool is not oriented towards commercialization
- Has contributed to a bias towards cyber "service" companies focused on defense (vs. cyber needs of other commercial market segments)



### POLICY AND REGULATORY ISSUES

This study did not involve an in-depth review of policies and regulations that impact Maryland's business environment; however, stakeholders did mention opportunities to review the state's current tax code and regulations to assess how they may be impacting innovation. Policies that may be having an (unintended) negative impact on entrepreneurship include:

- Income Taxes
- Estate taxes
- Zoning and permitting (in some counties)

Stakeholders point out that these policies have the potential to inhibit retention and attraction of "C" level talent that can support entrepreneurial ventures. It can also reduce the number of serial entrepreneurs and angel investors who are knowledgeable about the industries in which they invest and are willing to mentor and advise new entrepreneurs.

- "Maryland has a problem people won't put money where they can't hold on to it. Wealthy people don't want to live full-time in Maryland because of the tax structure. We don't talk about this as impacting innovation but Maryland's tax policy is a key issue that explains some of our gaps. It creates a hole in the bottom of the bucket." (Maryland Investor)
- "We lose a lot of potential investment capital that could be accessed by early stage companies because people who make money in Maryland ...people who have made money from exits or in industry or who are retired... leave the state. In CA or MA these are the folks who become part of the brain trust, the community of angel investors and the mentors." (Maryland Investor)



### **START-UP AND EXPANSION SPACE**

Most of the study participants believe that Maryland *does not* have a shortage of incubator space. Moreover, the state has a wide range of incubator types: industry specific, tied to academia. However, several issues related to space for start-ups were frequently mentioned:

- Many incubators do not have a policy of "up or out" where startups which are successful move out to independent space and startups which fail must leave the incubator
  - There should be a flow of companies moving in and out of the incubators, not staying indefinitely
  - There should be criteria for selecting start-ups that ware eligible to be in the incubator
- Few accelerating spaces (as compared to incubating spaces) which provide seed and pre-seed stage companies with subsidized space, mentoring services, and networking with peers
- Young companies in the life sciences need more commercial laboratory space for growth
- "There is too much emphasis on incubating space we have enough space, although it is spread out across the counties. Many of the incubators in Maryland are just real estate plays. They don't have an 'up and out' policy so companies are growing and taking up all the space and the incubators can't take in new companies. It creates an inaccurate perception that there is pent up demand for incubator space." (Investor)
- "Most of the incubators focus on revenues so they hold onto companies because there aren't more companies beating down the door to come in. It makes it hard to have a strong business case for investing in additional development in the state." (Developer)
- "We need expansion spaces -- and commercial lab space for life sciences companies -- not more incubators. I know of a company that is asking for more space in an incubator because they have grown to 200 people." (Entrepreneur)
- "We all know about some companies in incubators that are on life support, or existing on SBIR grants and not aggressively looking to raise money. But the incubators don't put pressure on them because they want the rents." (Entrepreneur)

# EXCELMaryland 2017



The community is not telling a unified story that celebrates the many good things that are happening in technology innovation in Maryland:

- The story needs to be told *within and outside* of Maryland
- Celebrate the successes wherever they are in the state
- Websites are not sufficient to market the state
- Promoting national rankings alone is not sufficient to convey Maryland's strengths and successes
- Maryland has many success stories and the people *behind those stories* are important potential brand ambassadors that must to be leveraged



### **Baltimore's Challenge**

Baltimore City was specifically cited for its tremendous growth in its population of young professionals and entrepreneurs. Recent success in the attraction and growth of the City's millennial and young professional population is showing sustained momentum and reinforce the City's appeal and opportunity to retain a talented and highly skilled workforce. These factors are central to recent national rankings placing Baltimore in the top five for U.S. cities in the growth of its entrepreneurial community and support of minority entrepreneurship. Not surprisingly, people with no direct ties to Baltimore have concerns that mirror those of most urban centers related to education, crime, and transportation. There is strong evidence of Baltimore building innovative public-private initiatives and engaging a strong non-profit community to advance economic opportunities to address these concerns.

A unified story will:

- Create more awareness of Maryland's strengths and successes
- Help strengthen the ecosystem in Maryland
- Bolster everyone's awareness of the exciting things that are happening in the state
- Give a sense of unity and the importance of innovation and entrepreneurship
- "We can't really trumpet cybersecurity because there isn't a focal point or a story built around a focal point." (Business Advisor)
- "Tell the story that there is good stuff going on in Maryland - create a buzz!" (Serial Entrepreneur)
- "Maryland hasn't built its "character" around anything what should we be paying attention to in Maryland? What is their calling card?" (VC Outside Maryland)
- "We focus too much on what doesn't go well. We need a positive story that we all can tell and makes us all feel good about being here." (Entrepreneur)



### **GAP ANALYSIS: IDENTIFYING STRATEGIC PRIORITIES**

A major objective of the diagnostic assessment was to inform decisions regarding Excel Maryland's most important priorities. The analysis to identify these strategic priorities was conducted in the following steps:

- The perspectives of all stakeholders who participated in the study were synthesized (all participants were asked what they believed Excel Maryland's top priorities should be)
- Results were tabulated from a self-administered exercise completed by nearly 100 (97) of the study participants in Maryland to provide input to the question:

Q: "What should the Excel Maryland Initiative's *top priorities and targets for investments* be over the next 1-3 years to close gaps in innovation capacity?"

- As part of this exercise, participants were asked to list their top 5 priorities and then allocate 100 points across those priorities. The exercise is shown in Appendix C of this report
- The consultants reviewed the stakeholder feedback from the perspective of our overall data collection as well as our experience with other successful innovation initiatives.
- The purpose of the analysis was to compare stakeholder perceptions vs. the true needs of the innovation community.

Figure 9 on the following page shows the results of the exercise – displaying the top six priorities based on total points received.

### Figure 9: Stakeholder View of Priorities for Excel Maryland



Stakeholders who participated in the

Areas of Greatest Convergence Across Stakeholders\* (Highest # of Points Awarded)

- 1. Availability of Capital: "A Round" and beyond (1485 points)
- 2. Focal point for a coordinated strategy (1068 points)
- 3. Messaging (lack of) a unified "Maryland Story" (968 points)
- 4. "C" level and operational talent to grow young companies and raise capital (840 points)
- 5. Tech transfer and spin out of new companies (580 points)
- 6. Venture mentoring (523 points)

Our analysis indicates there are **important gaps that are not as highly prioritized as they should be**. If Excel Maryland's priorities had been developed today, some important priorities would have been missed based on both the consultants' experience and factors that have led to success in high growth innovation economies.

Overall, the "gap analysis" exercise indicates that stakeholders focus on activities that target *individual gaps and enablers*, but generally **don't prioritize activities that will** *improve how**innovation enablers work together* **to close gaps and strengthen innovation capacity overall. Because the enablers of innovation are inter-related and mutually reinforcing, efforts to strengthen innovation capacity must be based on a systems approach and employ a portfolio of interventions.** 

# EXCELMaryland 2017



#### Ecosystem

Was *NOT identified* as a priority but <u>should be ranked #1.</u> Maryland's loosely coalesced ecosystem is the *gap most frequently highlighted* by investors in and outside Maryland as an important reason for their level of confidence about putting investment capital into Maryland start-ups vs. start-ups in other innovation hubs.



The Maryland "cluster" is a collection of assets – universities, medical centers, companies, investors, service providers, etc.

What is needed is an innovation "ecosystem" where all members of the cluster work well together!



#### **Availability of Capital**

The availability of capital was Ranked #1 across all stakeholders who participated in the exercise, but, as discussed earlier in this report, the lack of capital is due to Maryland's loosely coalesced ecosystem. Simply increasing the *availability of capital will not, by itself, have the desired impact.* 

When an ecosystem is strong, it "attracts capital:"

- Angel
- Venture
- Corporate
- Philanthropic



#### Focal point for integrated strategy, investment and communications

Having a single entity assume overall responsibility for strengthening Maryland's innovation capacity is *ranked as #2 in the point allocation exercise. This ranking is consistent with the research findings regarding its importance.* 

Stakeholders believe that a single entity whose day-to-to-day activities are focused on eliminating fragmentation at all levels will:

- Strengthen coordination, collaboration and potential for impact
- Optimize allocation of resources and encourage strategic decision-making across the entire innovation community



#### **Public-Private Partnership**

**This attribute was NOT identified as a priority in the survey**. Stakeholders in this study frequently assume that state government will take responsibility for Excel Maryland. However, lessons from other state's innovation initiatives have demonstrated that:

- The public sector alone will not be able to achieve the goals of Excel Maryland --but state government has a key role to play in strengthening "innovation capacity" in Maryland
- Industry and academia must be committed to a shared vision, strategy and high level of engagement for Excel Maryland to be successful



### IMPLICATIONS FOR EXCEL MARYLAND

#### THE VISION

Maryland's vision of being **"THE" leader in Cybersecurity** *is* **possible**. The cyber sectors of the economy are growing and evolving – no state has yet emerged as the undisputed "leader." As Maryland is solidifying its leadership in cyber security, stakeholders should pay attention to several geographies that also are positioning themselves as major cyber hubs. Like Maryland, these geographies can boast universities that are "strong in cyber."

- Austin, TX
- Huntsville, AL (Re-branding itself as "Cyber City USA")
- Miami, FL
- Omaha, NE
- Pittsburgh, PA
- Rome and Syracuse, NY (Central New York State)

Maryland is well-positioned to be "THE" leader in niche areas of the life sciences, such as cell therapies, vaccines and selected cancers. A more realistic vision for Maryland in life sciences overall is to be "A" life sciences leader. The Life Sciences are a more mature collection of industry sectors. It will be difficult for Maryland to "leapfrog" geographies that already have established themselves as "the" overall life sciences leaders.



#### **OPPORTUNITIES FOR SYNERGY**

Strengthening Maryland's Innovation Capacity will benefit **both** Cyber and the Life Sciences industries. Maryland has gaps in its overall capacity to grow an innovation economy – and there are *no significant differences* in the gaps for life sciences and cyber. Maryland's strengths in cyber security currently exceed its strengths in life sciences, but to get traction, Excel Maryland will need to address the underlying gaps in innovation capacity that *affect them both*. Study participants and cyber experts note that there are significant growth opportunities in cyber innovation especially at the intersecting points of cyber and life sciences.

Excel Maryland may gain greater competitive advantage using a strategy that views cyber and life sciences as *complementary and related industry sectors -* as opposed to silos



#### **CONSOLIDATION AND COLLABORATION**

Prioritize Ecosystem Building -- Consolidation, Collaboration and De-Fragmentation

As Maryland develops greater critical mass it will be important that existing resources work together as an ecosystem and produce the highest possible leverage.





#### COALESCE A SUPPORT SYSTEM FOR ENTREPRENEURSHIP

The goal: increased number of startups poised for growth. A well-coalesced support system provides:

- Ready access to sources of new technology (universities, research institutions, mature companies)
- Business plan competitions:
  - Encourage entrepreneurial thinking
  - Provide coaching
  - Increase visibility to investors
- Human capital:
  - Trained technologists
  - Managers
  - Experienced entrepreneurs
  - C-level executives
- Mentors and Role Models
- Experienced entrepreneurs
- Visible, accessible

- Sources of pre-seed capital, both grants and investments from many sources:
  - University and other institutional grants
  - State agencies
  - Philanthropists and Foundations
- Multiple sources of investment capital
  - Knowledgeable individual angel investors
  - Angel networks
  - Venture capital funds
- Accelerators and Incubators
  - Affordable space for growth
- Multiple venues for community networking

# EXCELMaryland 2017

#### CREATE A COORDINATING ENTITY FOR THE INITIATIVE



The coordinating entity should have the capabilities and resources to directly address stakeholder needs but also should play a major role in promoting collaborations and *making referrals* to other organizations and agencies with capabilities and resources to meet stakeholder needs.



The entity should include staff with specialized sector expertise but emphasize coordinating and highly leveraging resources and investments that *strengthen Maryland's innovation capacity overall.* 



At the outset, the Initiative will need to optimize resources and this is better accomplished by coordinating the disaggregated efforts that exist across the state and creating opportunities for collaboration.



#### COMMUNICATIONS AND MARKETING

Develop the **innovation Story for Maryland** and invest aggressively in communicating the story.

- Have a significant presence at the key industry conferences for cyber and life sciences
- Encourage senior state officials (and Legislators) to be highly visible members of the "marketing team"
- Promote niches where expertise, technology innovation, and scientific research in Maryland is ahead of the curve



#### COMMIT TO THE EXCEL MARYLAND INITIATIVE

From the outset, Excel Maryland MUST have "success metrics" that can be *tracked*, *communicated*, *marketed* and *celebrated* 

- What does "success" look like for Excel Maryland?
  - The level of engagement, investment and support for Excel Maryland must match the vision and the message
  - Stakeholders in MD frequently mentioned a strong need for "Commitment" and "Adequate Funding"

Stakeholders outside Maryland feel that they have "heard this vision before" and will be looking to see how "this time will be different." Stakeholders within Maryland will be paying great attention to the person who is "on point" for Excel Maryland – it must be someone who has credibility as well the right political "know how"

- "We keep starting over again with each new administration and we don't get traction or continuity. We need to take the long view so that we don't keep reinventing the wheel." (Business Council Executive)
- "If we do these studies we should take action on them and put what we learn from them together!!! Need to integrate everything into one conversation, one strategy, one collaborative effort, and one framework." (Executive)
- "Economic development is not the same as entrepreneurship. State funds can be used to create leverage but the private sector must drive innovation." (Maryland VC)



#### CONCLUSION

This report is merely a first step in moving Excel Maryland forward. In launching Excel Maryland and creating an Innovation Hub, the leadership team must recognize what the key priorities are for the initiative. First and foremost is the creation of an ecosystem, bringing together the array of activities and initiatives from around the state to partner and collaborate.

If this initiative is to be successful, it must address the following challenges, preferably within one coordinating entity:

- Ecosystem
- "Defragmentation"
- "Attractiveness to Capital"
- Executive Level Talent
- Maryland Innovation Story

The coordinating entity (the Innovation Hub) will create the Maryland Innovation story and share that broadly with partners from industry, academia and government. Having one "go to" organization that is accepted by the broader community will fight against the challenge of fragmentation of efforts in innovation and entrepreneurship. The Innovation Hub will become a focal point for all resources, organizations and activities to be shared and publicized. More start up activity will draw more executive level talent which will in turn attract more sources of capital. This will also need to be accompanied by the formalization of an active venture mentoring network that will strengthen a culture of entrepreneurship.

Through a collaborative effort between industry, academia and government Maryland has the opportunity to be recognized as a leader in technology innovation and entrepreneurship. *This will not happen overnight*. However, by leveraging its strengths and addressing the challenges discussed in this report, Maryland can lead the country in cybersecurity and be a major leader in life sciences innovation. With successes in these two arenas, other areas of technology innovation are likely to emerge as the marketplace evolves. Early wins and publicizing success stories will help accelerate the Maryland innovation economy and achieve the goals of Excel Maryland -- creating jobs, attracting companies and growing revenues.



# **APPENDICES:**

**Appendix A: Excel Maryland Steering Committee Members** 

**Appendix B: Study Participants** 

Appendix C: Ranking and Weighting Exercise

Appendix D: Additional Data on Maryland's Innovation Capabilities

**Appendix E: Review of Other Innovation Initiatives** 



# APPENDIX A: EXCEL MARYLAND STEERING COMMITTEE MEMBERS

# EXCELMaryland 2017



#### **EXCEL MARYLAND STEERING COMMITTEE MEMBERS**

Robert L. Caret, Chancellor, University System of Maryland (USM) – Co-Chair
Ronald J. Daniels, President, Johns Hopkins University – Co-Chair
Daniel J. Abdun-Nabi, CEO, Emergent BioSolutions and Chair, Maryland Life Sciences Advisory Board
Peter Barris, Managing General Partner, New Enterprise Associates
Tom Geddes, CEO, Plank Industries
Ron Gula, President, Gula Tech Adventures and Co-Founder, Tenable Network Security
Stephanie Hill, Vice President and General Manager, Lockheed Martin
Dr. Bahija Jallal, Executive Vice President, MedImmune and AstraZeneca
Larry Letow, President and CEO, Convergence Technology Consulting
Robert Lord, CEO, Protenus
Bill Niland, CEO, Harpoon Medical
Wendy Perrow, CEO, AsclepiX, Therapeutics
Paul Silber, Founding Principal, Blu Venture Investors

#### **Ex-Officio Members**

Robert C. Brennan, Executive Director, Maryland Economic Development Corp. (MEDCO) Mary Clapsaddle, Director of Staff Affairs, Johns Hopkins University Matthew Clark, Chief of Staff to Governor Hogan George Davis, CEO, Technology Development Corporation (TEDCO) James Fielder, Secretary of Higher Education, Maryland Higher Education Commission Mike Gill, Secretary of the Department of Commerce Michael L. Harrison, Director, Office of Policy Development, Department of Labor, Licensing and Regulation Patrick Hogan, Vice Chancellor for Government Relations, University System of Maryland (USM) Britta E. Vander Linden, Deputy Chief of Staff to Governor Hogan Sam Malhotra, Chief of Staff to Governor Hogan Sen. Martin G. Madden, Senior Advisor to Governor Hogan Sen. Robert Neall, Senior Advisor to Governor Hogan Matthew J. Palmer, Deputy Legislative Officer to Governor Hogan Steve Pennington, Managing Director, Business and Industry Sector Development, Department of Commerce Tom Sadowski, Vice Chancellor for Economic Development, University System of Maryland (USM) Kelly Schulz, Secretary of the Department of Labor, Licensing and Regulation Gen. Linda Singh, Adjutant General of Maryland Chris Shank, Chief Legislative Officer to Governor Hogan Cassie Shirk, Policy Advisor to Governor Hogan John Wasilisin, President and Chief Operating Officer, Technology Development Corporation (TEDCO) Craig Williams, Vice President for Health Innovations and Management Solutions, Johns Hopkins University John Wobensmith, Secretary of State Benjamin H. Wu, Deputy Secretary, Department of Commerce Christy Wyskiel, Senior Advisor to the President, Johns Hopkins University

# EXCELMaryland 2017







# APPENDIX B: INTERVIEW AND ROUNDTABLE SUMMARY



#### Interview Participants by Category:

Category	Number of interviews		
Academic Institutions	45		
Start-Up Community	84		
Industry	30		
State Government	23		
Other Stakeholders & Leaders	33		



# **APPENDIX C: RANKING AND WEIGHTING EXERCISE**



#### RANKING AND WEIGHTING EXERCISE

Rank order your top FIVE priorities. Then allocate 100 points across your top five priorities to indicate how you would prioritize each for investment (dollars, time and energy, etc.) You can allocate all 100 points to a single item if you wish.

	My top FIVE PRIORITIES for Excel Maryland		My WEIGHTING (allocate 100 points)
1.		-	
2.			
3			
4.			
5.			

Total = 100



# APPENDIX D: ADDITIONAL DATA ON MARYLAND'S INNOVATION CAPABILITIES



# ADDITIONAL DATA ON MARYLAND'S INNOVATION CAPABILITIES

- Maryland is ranked 3rd nationally for research and development intensity. (Michelle Jamrisko and Wei Lu, "Here Are The Most Innovative States In America In 2016," Bloomberg, 12/22/16)
- Maryland is ranked 2nd nationally for concentration of STEM employment. (Michelle Jamrisko and Wei Lu, "Here Are The Most Innovative States In America In 2016," Bloomberg, 12/22/16)
- Maryland is ranked 4th nationally in the number of science & engineering degree holders. (Michelle Jamrisko and Wei Lu, "Here Are The Most Innovative States In America In 2016," Bloomberg, 12/22/16)
- Maryland Is Ranked as The Most Innovative State in America According to WalletHub. (Richie Bernardo, "2017's Most & Least Innovative States," WalletHub, 5/23/17)
- Maryland is ranked 3rd nationally for having the highest share of STEM professionals. (Richie Bernardo, "2017's Most & Least Innovative States," WalletHub, 5/23/17)
- Maryland has the 2nd highest share nationally of science and engineering graduates aged 25+. (Richie Bernardo, "2017's Most & Least Innovative States," WalletHub, 5/23/17)
- Maryland ranks second nationally for the highest share of technology companies. (Richie Bernardo, "2017's Most & Least Innovative States," WalletHub, 5/23/17)
- Maryland ranks third nationally for the highest research and development spending per capita. (Richie Bernardo, "2017's Most & Least Innovative States," WalletHub, 5/23/17)



- Maryland Is Home to The Federal Government's Top Cyber Agencies:
  - National Security Agency (NSA)
  - U.S. Cyber Command
  - Defense Information Systems Agency (DISA)
  - United States Army Communications Electronic Command (CECOM) (Maryland Department of Commerce)
- Maryland Has an Unrivaled Community of Researchers and Educators
  - 17 National Centers Of Academic Excellence In Cyber Defense (Maryland Department Of Commerce; "National Centers Of Academic Excellence In Cyber Defense (CAE-CD), National Institute Of Standards And Technology, Accessed: 8/9/17)
- Maryland Is an Environment Where Entrepreneurs and Industry Leaders
   Alike Can Succeed


APPENDIX E: REVIEW OF OTHER INNOVATION INITIATIVES



## California

California's QB3 innovation hubs were created leveraging \$100mm of state funding. In 2000, the University of California created The California Institute for Quantitative Biosciences (QB3) and three other Gray Davis Institutes for Science and Innovation. Taken together, these four institutes represent a billion-dollar, multidisciplinary effort that focuses public/private resources and expertise simultaneously on research areas critical to sustaining California's economic growth and its competitiveness in the global marketplace.

The new ideas and technologies developed by researchers at the institutes help expand the state's economy into new industries and markets - and bring the benefits of innovation more quickly into the lives of people everywhere.



## Canada/Ontario

*Medical and Related Sciences (MaRS)*. MaRS Discovery District is a not-for-profit corporation founded by civic leaders in Toronto in 2000. Its stated goal is to commercialize publicly funded medical research and other technologies with the help of local private enterprises and as such is a public-private partnership. As part of its mission MaRS says, "MaRS helps create successful global businesses from Canada's science, technology and social innovation." As of 2014, startup companies emerging from MaRS had created more than 4,000 jobs, and in the period of 2011 to 2014 had raised over \$750 million in capital investments from the private sector and launched 6,000 new businesses.

Toronto successfully leveraged its Centers of Excellence by creating a strategy for the province of Ontario that resulted in the MaRS Discovery District, MaRS Innovation, and 18 regional innovation centers. The basis of this initiative is that supporting entrepreneurship supports risk takers with ideas that will allow adaptation to industries of the future. By leveraging the federal funding coming into their province, they pair entrepreneurs with researchers to create vibrant new companies.

MaRSs brings together educators, researchers, social scientists, entrepreneurs and business experts under one roof. Its mission is equal parts public and private — an entrepreneurial venture designed to bridge the gap between what people need and what governments can provide. MaRS works with corporations willing to leverage their global reach to assist startups seeking footholds in foreign markets. Corporations, in turn, embed teams at MaRS to boost creativity, scout talent and rekindle their entrepreneurial flames.

MaRS also offers MaRS Venture Services, whose main goal is to help entrepreneurs accelerate by providing expert advice, market intelligence and access to capital, as well as connections to talent and customers.

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#### Kentucky

*The Kentucky SBIR/STTR Program.* The Kentucky Science and Engineering Foundation (KSEF) offers SBIR/STTR assistance to Kentucky-based R&D businesses in the development of Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) proposals. This includes help at each of the three phases of SBIR/STTR. KSEF also partners with other organizations to sponsor events including: Phase I and Phase II SBIR/STTR workshops, an Kentucky SBIR/STTR Annual Conference, and training and networking opportunities. KSEF prepares Kentucky innovators, entrepreneurs, and technology-oriented small businesses (i.e. 500 or fewer people) and their Kentucky-based companies for success in the highly competitive SBIR/STTR grant programs.

The Federal SBIR and STTR programs provide grant money to small start-up businesses to develop products, technologies, or services that solve pressing problems in agriculture, defense, education, energy, transportation, the environment, space exploration, health, and other areas. SBIR and STTR are designed for high-risk, untested innovations -- not for conventional enterprises such as retail or service, or for technology companies with proven ideas. These Federal grants allow businesses to conduct feasibility studies in Phase I (up to \$150,000), the development of a prototype in Phase II (up to \$1,000,000), and eventual commercialization in Phase III using non-federal dollars.

- <u>KENTUCKY SBIR/STTR PHASE ZERO PROGRAM</u> -- SBIR/STTR Phase Zero grants assist Kentucky-based new and existing small businesses, and Kentucky's college and university faculty, with the preparation of high-quality, competitive **Phase I** proposals for submission to participating Federal SBIR and Federal STTR programs. This program provides grants up to \$4,000 to each successful applicant company.
- <u>KENTUCKY SBIR/STTR PHASE DOUBLE ZERO PROGRAM</u> -- Similar to the Phase Zero, SBIR/STTR Phase Double Zero grants assist Kentucky applicants with the preparation of high-quality, competitive Phase II, Direct Phase II, and Fast Track proposals for submission to participating Federal SBIR and Federal STTR programs. This program provides up to \$4,000 to each successful applicant company.



KENTUCKY SBIR/STTR MATCHING FUNDS PROGRAM -- Kentucky can double an applicant company's Federal SBIR/STTR award with a dollar-for-dollar grant to the Federal Phase I or Phase II SBIR/STTR award. Funds may be used for additional technical tasks or to support tasks that are allowable under the federal award (e.g. IP, market research, business development). KSTC administers the Kentucky SBIR/STTR Matching Funds Grant Program, which is funded by the Cabinet for Economic Development (CED) and the Office of Entrepreneurship (OOE). The competitive grant program provides matching grants, dollar-for-dollar, up to \$150,000 for Phase I, and up to \$500,000 per year (but for no more than two years) for Phase II SBIR/STTR grants from any of the participating federal agencies.



#### Massachusetts

**The Massachusetts Life Sciences Center**: In 2008, launched a bold 10-year \$1 billion Life Sciences Initiative under the leadership of Governor Deval Patrick (D). The initiative consolidated into one quasi-public organization (the Massachusetts Life Sciences Center) the programs and funds needed to support growth of the state's life sciences industry. The goals of the initiative were to invest in good science *and* good business; to strengthen Massachusetts' global leadership position in life science; to accelerate commercialization of the research underway in the state's academic institutions and medical centers; and to create jobs and drive economic growth.

The MLSC is funded from the state budget and state-issued bonds; can award tax incentives. Governed by a Board of Directors which approves all investments. Investment decisions are guided by a multi-disciplinary Advisory Board comprised of leaders in multiple life science disciplines, from industry, the investment community and academia. The MLSC makes grants, loans, infrastructure investments and tax incentives. Public dollars have been leveraged at a 3x multiplier by matching private investment.

A three-tiered funding approach supports the effort: \$500 million in capital funds for infrastructure, \$250 million in targeted tax credits, and \$250 million for investments in research and businesses.

The MLSC's strength stems from its ability to make grants and investments, and its ability to successfully develop partnerships and meaningful collaborations across industry, academia and government. Since the launch of the initiative, the life sciences sectors of the Massachusetts economy have grown over 17 percent, and are projected to grow another 17 percent by 2020. The leverage on the public dollars expended to date by the Life Sciences Initiative is a multiple of three (3) – over \$2B of net new investment by the private sector in Massachusetts., Massachusetts' current Governor, Charles Baker (R) recently announced his intention to recapitalize the initiative at current funding levels when it expires in 2018 – a testament to the success and the strength of the initiative's economic impact over the last nine years and its resulting sustainability across political administrations.

The Massachusetts Technology Collaborative (MassTech): In 1982, the Massachusetts legislature enacted legislation establishing a quasi-public organization to advance the growth of the technology sectors of the state's economy. MassTech is state funded and is governed by an overall Board, but also maintains separate advisory and governing boards for its individual divisions. MassTech has continually added divisions over the years to launch and administer innovation initiatives for the state. In its 32-year existence, MassTech has served as an incubator for numerous innovation initiatives, including cyber security, broadband, robotics, digital health, nanomanufacturing. MassTech's life sciences and clean energy initiatives ultimately were spun out to be administered by newly created quasi publics.



MassTech:

- Fosters the growth of dynamic, innovative businesses and industry clusters in MA, accelerating the creation and expansion of firms in technology-growth sectors
- Accelerates technology use and adoption, helping ensure statewide connectivity and promoting competitiveness
- Harnesses the value of research by supporting and funding research initiatives, and encouraging greater collaboration with industry to help bring ideas to market.

MassTech's strength stems from partnerships and industry insights. MassTech develops meaningful collaborations across industry, academia and government which serve as powerful catalysts, turning good ideas into economic opportunity. MassTech also produces *the Annual Index of the Massachusetts Innovation Economy*, the state's tool for benchmarking the status and progress of our innovation economy. Since 1997, the Index has provided users with a wealth of data and information for assessing the performance and progress of the Commonwealth's Innovation Economy. By means of 22 indicators, the Index offers a comprehensive view of several dimensions of the innovation ecosystem and focuses on 5 key Innovation Economy (IE) sectors in Massachusetts: Capital, Economic Impact, Research, Talent, and Technology & Business Development.





#### **New York**

*New York Life Sciences Initiative*. In December 2016 Governor Andrew M. Cuomo announced a groundbreaking new \$650 million Life Sciences Initiative to spur the growth of a new, worldclass life science research cluster in New York, as well as expand the state's ability to commercialize this research and grow the economy. The multi-faceted initiative includes \$250 million in tax incentives for new and existing life science companies, \$200 million in state capital grants to support investment in wet-lab and innovation space, \$100 million in investment capital for early stage life science initiatives, with an additional match of at least \$100 million for operating support from private sector partnerships. The initiative also will create more than 3.2 million square feet of innovation space and 1,100 acres of developable land available and tax free at 45 Colleges and Universities statewide. The initiative also includes new programs to help develop the research and entrepreneurial talent necessary for growing New York's Life Sciences sectors.

Specifically, the Governor's life science initiative includes:

# Providing \$250 Million in Tax Incentives for New and Existing Life Sciences Companies that are Expanding Research and Development

To better compete with other states actively poaching New York's top life science research talent, the state must draw more capital to this sector from early stage and angel investors, as well as make it more attractive for existing and new firms in life sciences to locate, invent, commercialize and produce in New York.

Under the Governor's program:

- Existing life science businesses would be eligible for an annual allocation of \$10 million in Excelsior tax credits;
- New life science businesses would receive a 15 percent refundable tax credit on all new qualifying research and development expenditures. Small businesses in the life sciences industry could be eligible for a 20 percent credit.
- Angel investors would receive a credit of 25 percent of their investment, with a maximum of \$250,000 per investor.

# EXCELMaryland 2017



Providing \$200 Million in State Capital Grants and Offering More Than 3.2 Million Square Feet of Space and 1,100 acres of Developable Land Tax Free to Accelerate Life Science Innovation Innovation in the life sciences requires state-of-the-art laboratory space, equipment and technology. The Governor's initiative invests \$200 million, over ten years, to support the capital needs of life science entities, positioning New York's wet labs and innovation space to be the place where future technologies are born.

Additionally, the lack of affordable and appropriate lab space has been cited as a barrier to New York reaching its potential in the life sciences. To remedy this, the state will also make more than 3.2 million square feet of innovation space and 1,100 acres of developable land available tax free at 45 colleges and universities statewide. The availability of grants, land and space creates an unprecedented opportunity to expand access to wet labs, infrastructure and other equipment essential for life sciences research, innovation and development.

# Providing \$100 Million in Investment Capital for Early Stage Life Sciences Initiatives, matched by at least \$100 Million from the Private Sector

As part of New York's commitment to the growth of this sector, the state is pledging \$100 million for additional investment capital for early stage life science firms. In addition, private sector partnerships are also pledging matching funds for investment and operational support, bringing the total commitment to \$200 million.

Part of the investment will include a new life science launch competition, modeled on the highly successful 43North innovation competition, will further support the growth of this sector. New York State will host a quarterly, 13-week regional life science launch competition in which firms conducting groundbreaking research and developing emerging technologies would compete for \$25,000 grant funding. All the quarterly winners will then compete for one of five \$100,000 top business launch prizes at a statewide annual Life Sciences Summit, which will gather top researchers, commercial firms venture funders and policymakers together to strategize next steps for continued aggressive growth of the life science sector.

# Developing Research and Entrepreneurial Talent Necessary for Launching and Growing Life Science Businesses

Access to talent and management expertise continues to be needed for early stage life science firms to succeed. To grow this talent base in New York, the initiative offers programs and partnerships that will attract top flight researchers to work with New York's academic centers and medical schools on the latest life science innovations. These include:

> A Life Sciences Internship Program to leverage New York's network of public/private academic centers to facilitate the placement of students--or recent graduates--enrolled in a life science field of study at a college or university located in New York into paid internships with a partnering life science company.

- A life sciences researcher recruitment program that will work with our academic medical colleges and other academic programs to attract top-flight life sciences researchers.
- Entrepreneurial Advisory Panels in Life Sciences that will match entrepreneurs and innovators with a panel of mentors that will help guide them in their business decisions, increasing the rate of success and growth of new firms in New York State.
- Partnership with the Empire Clinical Research Investigator Program administered by the New York State Department of Health, which provides over \$8.5 million annually to teaching hospitals that train physicians as clinical researchers in order to advance life sciences research in New York to attract and retain the best life sciences researchers.

The initiative is being guided by a new Life Sciences Advisory Board, comprised of leaders in multiple life science disciplines, both from industry and academia. The membership of the board will be announced with the Governor's 2017 State of the State address.



## North Carolina

**The North Carolina Biotechnology Center** is a private, non-profit organization located in Research Triangle Park, North Carolina. Founded in 1984 by the North Carolina General Assembly, it was the first state-sponsored biotechnology initiative in the United States, merging the interests of the academic private and public sectors. The North Carolina Biotechnology Center's mission is to provide long-term economic and societal benefits to North Carolina through support of biotechnology research, business, education and strategic policy. It receives nearly all of its funding from the North Carolina General Assembly.

Since 1984, the North Carolina Biotechnology Center has invested more than \$187 million in state monies to develop biotechnology statewide. It is not a site for laboratory research or company incubation, but it works to strengthen the research capabilities of North Carolina's companies and universities.

The North Carolina Biotechnology Center works toward six goals:

- Strengthen North Carolina's academic and industrial biotechnology research capabilities.
- Foster North Carolina's biotechnology industrial development.
- Work with business, government and academia to move biotechnology from research to commercialization in North Carolina.
- Inform North Carolinians about the science, applications, benefits and issues of biotechnology.
- Enhance the teaching and workforce-training capabilities of North Carolina's educational institutions.
- Establish North Carolina as a preeminent international location for the biotechnology industry.



### Pennsylvania

**Ben Franklin Technology Partners**. BFTP is an initiative of the Pennsylvania Department of Community and Economic Development; funded by the Ben Franklin Technology Development Authority. Ben Franklin Technology Partners is one of the nation's longest-running technology-based economic development programs (31 years old). Provides both early-stage and established companies with funding, business and technical expertise and access to a network of innovative, expert resources. The Authority's board consists of Pennsylvania leaders including elected officials and thought leaders in higher education, finance, technology and nonprofit economic development organizations. BFTP is considered Pennsylvania's leading source for the technology strategy and funding.

BFTP provides access to capital, business expertise and a network of resources that foster innovation, growth and success for both startup companies and established businesses. It seeds and fosters valuable business and technology networks that bring ideas and operational talent together to grow new businesses in Pennsylvania. These networks are often the early elements of regional clusters that spawn new companies and improve the region's and state's capacity for innovation.

Network members include all key stakeholders:

- Entrepreneurs
- Venture capitalists
- Business incubators
- Universities
- Economic development organizations
- Corporations
- Federal research labs
- Government

Since its inception, BFTP has been responsible for \$23.5B in contributions to the Pennsylvania economy and 140,000 net new jobs.