

EXPLORING ENTREPRENEURSHIP

at the University of Maryland, Baltimore



UNIVERSITY of MARYLAND
THE FOUNDING CAMPUS



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INTRODUCTION

The 2017-2021 University of Maryland, Baltimore (UMB) Strategic Plan emphasizes that UMB will achieve its goal of becoming a dominant economic leader in the region through innovation and entrepreneurship. The plan seeks to harness UMB's strengths in interdisciplinary and interprofessional teamwork to serve as a catalyst for economic development. This plan incorporates initiatives from all of UMB's seven schools: the Graduate School, School of Dentistry, Law, Medicine, Nursing, Pharmacy, and Social Work.

Therefore, the 2016-2017 President's Fellows, an interdisciplinary group of UMB students, have been tasked with writing this white paper to assess the current state of entrepreneurship at UMB, to identify existing gaps, and to make appropriate recommendations.

In order to accomplish our mission, we evaluated current practices at UMB through interviews with leading officials, and performed extensive research on the best practices at top institutions. To more quantitatively assess the state of entrepreneurship at UMB, we designed and gathered results from a student survey. Combined, our research and survey results have led to a series of recommendations, with the ultimate goal of fostering a culture of entrepreneurship at UMB.

WHAT IS ENTREPRENEURSHIP?

Throughout our discovery process, the first question we asked each interviewee was "What is your definition of entrepreneurship?" Whether an experienced life science entrepreneur or a Baltimore City social entrepreneur, each interviewee expressed the same common element: entrepreneurship is taking action. Entrepreneurship is a spirit of enterprise that facilitates innovation. This entrepreneurial spirit can result in a variety of outcomes, including self-employment, startups, or even changes to more innovative modes of thought. When entrepreneurs take action, such efforts go directly toward implementing solutions. Therefore, when the word entrepreneurship is used in this white paper, we define it as taking action.

In this report, we repeatedly use the terms innovation and entrepreneurship together. Innovation describes the process of implementing solutions to turn a new idea or invention

into a viable application with value. Entrepreneurship, or taking action, by our definition, provides the appropriate environment for such innovation to take place.

In defining entrepreneurship, we have also taken into consideration the vast and growing field of scholarship surrounding it. Literature involving higher education entrepreneurship as well as entrepreneurship addressing social issues was consulted in order to come to a fundamental definition for this report.

ENTREPRENEURSHIP IN HIGHER EDUCATION

UMB is not alone in its desire to promote entrepreneurship and innovation at a university level. With the enactment of the Bayh-Dole Act in 1980, universities and inventors, for the first time, were allowed to retain ownership of discovered technologies using federal funds (Grimaldi, 2011). Much of our nation's innovation takes place in a university setting, and university entrepreneurship has accounted for improvements in various fields including technology and medicine. Higher education is the largest sector receiving state and federal government grant funding and therefore has an obligation to commercialize its innovations, which in turn stimulates the economy. Academic entrepreneurship brings innovations to the forefront, driving economic growth, creating jobs, and improving quality of life (Galindo, 2014). In fact, a majority of US job creation over the last twenty years has occurred in startups or small firms (U.S. Department of Commerce, 2013). Therefore, it is no surprise that universities nationwide are attempting to increase both faculty and student entrepreneurial skillsets.

BENEFITS OF ENTREPRENEURSHIP

Real-world examples at other institutions give us an idea of the benefits of supporting entrepreneurship in a university setting. In 2015, Rice University's Business Plan Competition awarded more than \$1.35 million, and 154 past competitors are today in business, having raised more than \$1.2 billion (Rice University, 2015, Rice Alliance for Technology and Entrepreneurship). At Harvard University, the Office of Technology Development has helped innovators obtain 125 U.S. patents and receive approximately \$43 million in industry-sponsored research in one year (Harvard Medical School, 2017). Considering UMB's diverse, patient- and client-centric

professions, coupled with innovative research in science and technology, we too could make a huge impact on our community and world.

The UMB mission is “[to] improve the human condition and serve the public good of Maryland and society at-large through education, research, clinical care, and service” (University of Maryland, Baltimore, 2017). Entrepreneurship can significantly help UMB achieve this mission. Especially in the midst of decreased available funding nationwide, projects with an entrepreneurial focus have become embedded in what funding agencies require. Beyond traditional funding, it can also generate new financial streams.

Entrepreneurship at UMB can lead to numerous benefits for the individual, university, community, and society, as seen in Table 1. With university collaboration, faculty, staff, and students gain opportunities, the university is rejuvenated with new ways of thinking, and developments in the local community and society are strengthened (fig.7).

TABLE 1: BENEFITS OF ENTREPRENEURSHIP AT UMB

FACULTY, STAFF, AND STUDENTS

- New opportunities for faculty, staff, and students
- Recruitment of innovative faculty, staff, and students who will change the world for the better in the future

UNIVERSITY

- Meeting and exceeding changing standards for universities and university funding agencies
- New ways of thinking and teaching
- Financial support to allow the school achieve its vision and mission

LOCAL COMMUNITY AND SOCIETY

- New partnerships with industry and nonprofit organizations
- New, high-risk products and inventions brought to market
- Creation of new businesses and jobs
- Social change

EXISTING ENTREPRENEURSHIP INITIATIVES AT UMB

UMB has already established a strong foundation for its entrepreneurship and innovation ecosystem in five major areas: institutional, curricular, faculty, student, and community-based initiatives.

INSTITUTIONAL INITIATIVES

OFFICE OF RESEARCH AND DEVELOPMENT

The Office of Research and Development (ORD) advances research and economic development at UMB and serves as an umbrella organization that organizes much of UMB’s entrepreneurship initiatives at an institutional level. Principally, the ORD has three main projects that demonstrate UMB’s entrepreneurial spirit:

1. Technology commercialization
2. Corporate sponsored research and clinical trials
3. UMB BioPark

1. TECHNOLOGY COMMERCIALIZATION: OFFICE OF TECHNOLOGY TRANSFER AND NEW VENTURES

The UMB Office of Technology Transfer (OTT) is responsible for the commercialization of university developed technologies through licensing or new venture creation. Staffed with intellectual property attorneys, technology licensing officers, and marketing officers, the Office of Technology Transfer intakes disclosed inventions from faculty. From there, the office determines whether to move forward and file a patent, based on the technologies patentability and market potential. After a patent is filed, the OTT works to find appropriate industry partners with whom they should license the technology, delivering value to the University and inventor. The OTT can even assist with small seed funds if a technology is considered especially close to commercialization. With the addition of a venture creation wing in UMB New Ventures, the office has increased its ability to create new ventures beyond licensing. By providing expert advice in all aspects of the biomedical startup process, the UMB New Ventures initiative can facilitate innovation and entrepreneurship. Over the past five years, new start-up creation has risen from three companies per year in 2011 to ten companies in 2016.

2. CORPORATE SPONSORED RESEARCH

According to our definition of entrepreneurship, pursuing any sponsored research through foundational, government, or private grants, is considered an entrepreneurial activity. Establishing a connection to the corporate world is an important funding strategy for many faculty who focus on translational research. One example is the development of both the Ebola and HIV vaccines through corporate sponsored research. This research was made possible by partnership between Merck, Sharp & Dohme, the World Health Organization, and Paragon Bioservices.

3. UMB BIOPARK

The mission of UMB BioPark is to “create a university-associated research park that accelerates biotechnology commercialization and economic development in the surrounding community and throughout the region.” With its first building opening in 2005, BioPark has grown into a multi building complex with tenants spread across multiple sectors, including biotechnology companies, contract research organizations, workforce development organizations, services, clinical centers, research institutions, and University of Maryland departments/schools. The BioPark promotes UMB entrepreneurship by providing an interface between the Baltimore Biotechnology business community and the university. BioPark also serves as the next step for UMB spinout companies and provides affordable wet lab and office space for emerging companies in their BioInnovation Center. While expanding into the West Baltimore community, BioPark has remained committed to community development. The continued expansion of BioPark in the future bodes well for the UMB entrepreneurial community.

HEALTH SCIENCES LIBRARY INNOVATION SPACE

A welcomed addition to the UMB innovation ecosystem has been the Health Sciences Library Innovation Space. Equipped with 3D printers, 3D scanners, and other design materials, the Innovation Space provides a physical location for students, faculty, and researchers to experiment and design. The Innovation Space also includes opportunities for self education as well as workshops on 3D printing.

CURRICULAR INITIATIVES

UMB has begun to address areas related to entrepreneurship with some new initiatives such as the Entrepreneurship in Life Sciences Course and the President’s Entrepreneurship Fellowship, directed out of the New Ventures office on campus. The course hosts multiple speakers throughout the semester, gathered from various sectors of the life science business field. These include issues such as intellectual property, regulatory affairs, and funding.

The President’s Entrepreneurship Fellowship aims to more formally develop the skills of young innovators. UM Ventures takes students and pairs them with real, ongoing projects within the department. These projects include FDA Q submissions, 510Ks, and MII grant writing. The exposure to business related enterprise allows students to bridge their unique perspectives from their respective disciplines and apply them to a project.

FACULTY INITIATIVES

UMB has had success with faculty entrepreneurship, and continues to make it a priority. UMB celebrates faculty entrepreneurship through its annual Entrepreneur of the Year award. Awardees have often started successful companies, and contribute to the UMB entrepreneurial community by providing both resources and mentorship. Furthermore, experienced entrepreneurial faculty have assisted the OTT in reviewing new disclosures with potential for new venture creation.

The university has had multiple successful spinout companies and faculty entrepreneurs. Some notable examples of successful UMB faculty who started companies include:

HARPOON MEDICAL

Harpoon Medical has successfully raised venture capital and entered clinical trials for their medical device developed by a UMB physician. Their innovative, minimally invasive mitral valve repair device reduces incision size and surgery time.

ANALYTICAL INFORMATICS

Founded by members of the imaging informatics team at the School of Medicine, Analytical Informatics seeks to work with physicians to build software that can solve healthcare problems. The team at Analytical Informatics seeks to give back to the UMB community as well. CEO Chris Meenan, a former

UMB Entrepreneur of the Year, remains passionate about building the UMB innovation ecosystem through mentorship and new company development.

ASULON THERAPEUTICS

Asulon Therapeutics is currently changing the paradigm for treatment of depression and for faculty-student commercial collaborations. Founded by Professor Scott Thompson and his former student Adam Van Dyke, Asulon is developing small molecule drugs that treat depression through a novel pathway. The company was founded while CEO Adam Van Dyke was still a graduate student, suggesting that further faculty-student collaborations are a viable pathway to commercialization and entrepreneurial careers.

STUDENT INITIATIVES

Student interest in entrepreneurship and innovation has risen over the past years. Many students have taken it upon themselves to find resources and opportunities, as evidenced by an increase in student led groups and initiatives. Student groups in multiple schools including the Graduate School's Scientists for Non Academic Careers, the School of Medicine's Business of Medicine, and the School of Pharmacy's Academy of Managed Care Pharmacy and National Community Pharmacists Association chapters. These groups all promote entrepreneurship and alternative career exploration for their members.

The Entrepreneurship and Innovation Network (EIN) is the first student group dedicated solely to promoting an interdisciplinary entrepreneurial ecosystem at UMB. Established in 2015 by students from the Graduate School, School of Medicine, and School of Pharmacy, the EIN supports student innovation and entrepreneurship through education, mentorship, and experiences. With an extracurricular workshop series entitled "From Idea to Startup", EIN brings in speakers to educate all UMB students and faculty on the steps necessary in the startup process. Recently, EIN has begun a partnership with local incubators to provide its members with entrepreneurial experiences in established startup companies.

Increased UMB-led opportunities for student entrepreneurship beyond the curriculum have begun to emerge as well. The Office of Student Affairs within the School of Medicine recently hosted its first "LightBulb" Pitching Competition, in which participants receive recognition and compete for

prizes to support the development and commercialization of an important new product, technology, or concept. Career development offices from various schools have also started providing educational seminars focused on entrepreneurship. Furthermore, the Office of Student Development and Leadership provides basic educational seminars.

Students have also applied to competitions and programs outside of the University. By taking part in activities such as the National Science Foundation (NSF) sponsored I-Corps program and the National Cancer Institute Nanotech Challenge, students have expanded their networks outside of UMB into the greater Baltimore and Maryland entrepreneurial community. Students have also begun to participate in UMB spinout companies, both involved with faculty and on their own.

In sum, the recent growth in student entrepreneurship from both an institutional and student-led perspective captures the innovative potential of the UMB student body.

COMMUNITY-BASED INITIATIVES

In line with its mission, UMB has continued to focus on community engagement. In 2016, UMB launched the Community Engagement Center (CEC) which seeks to assist the West Baltimore community surrounding UMB. The center considers itself a "place-based" strategy for addressing the needs of residents of the West Baltimore community. Students, faculty, staff, and volunteers from every professional program pull their resources and scholarship together to identify needs of West Baltimore community residents and connect them to resources. Some of these resources include health screenings and referrals, job readiness counseling, community-organizing workshops, voting services and more.

One strong community partnership that the community engagement center has is with The Baltimore Gift Economy. The mission of this social enterprise is to encourage a community of reciprocal giving and receiving, in which Baltimore residents discover and cultivate their gifts and talents and channel their efforts towards long-term community growth. For example, every Wednesday, the Baltimore Gift Economy sells bags full of discounted groceries and use the proceeds for life skills programming. The CEC plans to support many more community leaders once their team secures a permanent space with a larger capacity.

In addition to the CEC, UMB schools also have community-based initiatives. At the School of Pharmacy, the innovative PATIENTS Program partners with West Baltimore community members to ensure that these patients are “heard, inspired, and empowered to co-develop patient-centered outcomes research” (University of Maryland School of Pharmacy, 2017).

CHALLENGES TO ENTREPRENEURSHIP INITIATIVES AT UMB

As mentioned in the previous sections, UMB promotes entrepreneurship in many ways; however, there is room for improvement. Our goal is to build an efficiently functioning ecosystem that promotes a culture of entrepreneurship and innovation at UMB. Several key issues must be overcome in order to attain UMB’s mission and develop this culture.

INSTITUTIONAL CHALLENGES

Almost every administrator interviewed provided examples of initiatives occurring under their school or department designed to foster entrepreneurship and innovation. However, top administrators could not always identify other schools’ initiatives or programs, which were often times identical and sought to solve the same issue. UMB highly regards the importance of multidisciplinary work and collaboration, yet struggles to communicate in regards to entrepreneurship.

For example, three separate and distinct physical innovation spaces/incubators are in the planning stages, all with the common goal of providing students with a space to develop ideas and establish basic business ethos. This enthusiasm for entrepreneurship and desire for these spaces is a great “problem” to have. However, due to lack of communication between schools, a more efficient use of resources has been prevented, also potentially preventing successful implementation of plans. This serves as just one example of how increased communication has stifled the progress of UMB’s entrepreneurial spirit.

CURRICULAR CHALLENGES

In terms of entrepreneurship, UMB’s interdisciplinary, professional school-based student community serves as a tremendous advantage, but also has some setbacks. Students in professional schools are focused on their next exam or rotation, leaving little room for innovation. Courses or distinct modules covering entrepreneurship and innovation are limited,

and not built into current curricula. Furthermore, faculty and the administration do not encourage leaving the academic lane. For many stipend-supported students, following the academic path is labeled as the only viable option. They must neglect alternative careers related to entrepreneurship, despite their growing necessity and prevalence. These factors limit student-based entrepreneurial endeavors to outside of the curriculum, thus lacking full-fledged university support.

FACULTY CHALLENGES

Much of the focus of UMB has been to promote faculty entrepreneurship. However, there is still a disparity among faculty members. Again, professors have the opportunity to disclose new patentable technology to campus to protect their inventions. According to the Office of Technology Transfer, entrepreneurially-inclined professors account for a large majority of invention disclosures - 90% of disclosures come from 10-20% of the faculty. Many professors seem to be focused on obtaining grant funds through traditional routes and are unaware of the nontraditional, more entrepreneurial pathways. Further, most faculty researchers’ first instincts are to publish, not check with the OTT to determine any commercial value of their research. Many faculty members will say they are researchers, not entrepreneurs, drawing an arbitrary distinction. Altogether, some faculty do not seem to be informed of the benefits of the entrepreneurial spirit in terms of their own careers.

Faculty enthusiasm for entrepreneurship has direct implications on UMB students as well. If faculty are not aware or motivated to innovate, neither then will their students. In many cases, faculty determine the project scope and funding for students, and can therefore either permit or restrict a student’s entrepreneurial endeavors. If only 10-20% of faculty are consistently disclosing new technologies, this can set a negative precedent for aspiring student entrepreneurs.

STUDENT CHALLENGES

In order to quantitatively assess the current state of student innovation, we, in collaboration with EIN, surveyed the UMB student body. The survey tallied over 240 students with even representation among UMB schools. Notably, a majority of survey participants were in the first two years of their respective programs.

An overwhelming 77% of students surveyed said they were interested in entrepreneurship and innovation. However, about half of the students responded that creativity, entre-

preneurship, and/or innovation either only occasionally, or rarely fit into their field of study (fig. 1), indicating a disconnect between the growing UMB entrepreneurial spirit and actual student experience.

In addition to managing their ongoing studies, most students do not have much time to act as student innovators. The majority of students surveyed only find time to act as student innovators between once a month or once a semester (see fig. 2 for a detailed breakdown). We asked students how much more of an emphasis they would like placed on entrepreneurship and innovation in their current studies. While most students thought UMB supported entrepreneurship and innovation a moderate (35%) to considerable (31%) amount, they still would have liked to see UMB place a stronger emphasis. Forty percent of students responded that they wanted significantly more emphasis, followed by 30% wanting moderately more. Only 3% of students were not in-

terested in more of an emphasis placed on entrepreneurship in their current studies (fig. 3).

Furthermore, a majority of students answered that they would be extremely interested in learning more about entrepreneurship, innovation, and related careers in their specified field of study as well as participate in entrepreneurial projects and activities (fig. 4 and 5).

Our qualitative interview data, in addition to our survey data, clearly illustrates a disconnect between the campus-wide entrepreneurial culture UMB strives for and the realities of current UMB school curricula. Students want and expect more out of UMB in terms of entrepreneurship and innovation. If a culture of entrepreneurship and innovation were more ingrained into daily school life, students might feel like they have more time and increased opportunity to innovate within their respective fields.

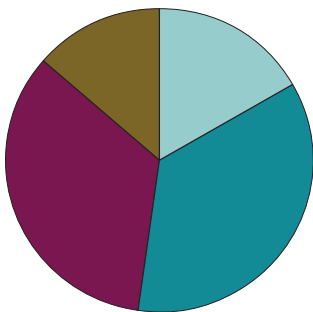


FIGURE 1

How frequently does creativity, entrepreneurship, and/or innovation fit into your field of study?

- Always
- Often
- Occasionally
- Rarely

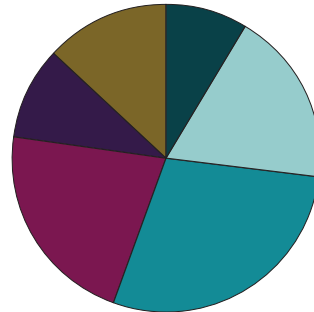


FIGURE 2

How much time do you have to act as a student innovator (in addition to managing your academic responsibilities?)

- Daily
- Weekly
- Monthly
- Once a semester
- Once a year
- Never

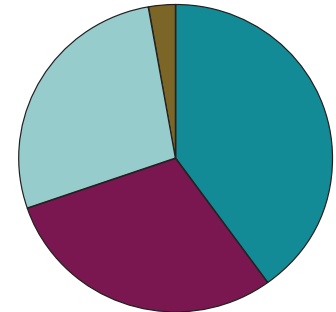


FIGURE 3

How much more of an emphasis would you like to be placed on entrepreneurship and innovation in your studies?

- Significantly more
- Moderately more
- Slightly more
- Not at all

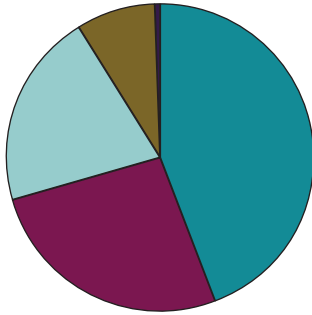


FIGURE 4

Level of interest in learning more about entrepreneurship, innovation, and careers related to your field of study

- Extremely interested
- Very interested
- Moderately interested
- Slightly interested
- Not at all interested

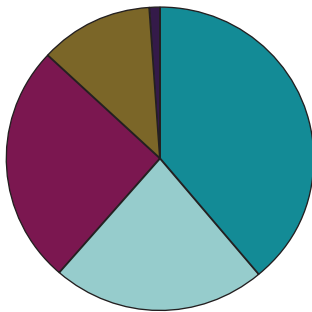


FIGURE 5

Level of interest in participating in entrepreneurial activities/projects

- Extremely interested
- Very interested
- Moderately interested
- Slightly interested
- Not at all interested

COMMUNITY-BASED CHALLENGES

UMB members also face barriers when trying to form successful business partnerships with local communities. A key challenge is the disconnect between the people who work at UMB and the surrounding communities.

For example, some UMB members are not aware of the current state of business and community development in West Baltimore communities. When a former adjunct faculty at the School of Social Work tried to redirect UMB purchasing to use West Baltimore businesses, some UMB members were not familiar with West Baltimore’s worker-owned cooperatives. These cooperatives provide jobs to hard-to-employ residents such as individuals with criminal backgrounds.

Another challenge is the deficit of in-house, technical talent. As this new initiative tried to develop a network of worker-owned cooperatives, the faculty member needed to rely heavily on UMB to build resources, such as technical expertise. The extra training required for workers can be costly in both time and money, making it even more difficult to demonstrate the business’s profitability in a short period of time.

BEST PRACTICES AROUND ENTREPRENEURSHIP

Nationwide, many universities have built or are in the process of developing their own entrepreneurial ecosystems. Below we provide a brief flavor of the diverse types of entrepreneurial initiatives we see from our fellow universities.

INSTITUTIONAL PRACTICES

OFFICE OF TECHNOLOGY TRANSFER

Most universities, such as Stanford, Harvard, and UMB, also have an office dedicated to helping faculty, staff, and students commercialize technology (Stanford University Office of Technology Licensing, n.d.; Harvard Medical School, 2017).

SEED FUNDING AND GRANTS

Universities, such as Berkeley, MIT, and University of North Carolina Chapel Hill, provide funding to support various entrepreneurship initiatives, such as early-stage startups and commercialization of breakthrough technologies and inventions (Table 2).

PHYSICAL SPACE AND INCUBATORS

Many universities also provide dedicated space for students to use. This may range from co-working space like the UMCP Startup Shell and Stanford Venture Studio (Stanford Graduate School of Business, n.d., Entrepreneurship) to an expanded center with additional small and large conference rooms and a cafe (Martin Trust Center for MIT Entrepreneurship, n.d.).

Other universities like University of North Carolina at Chapel Hill and University of Illinois even house their own incubators, which provide desks, space, and equipment like wet lab materials for startup companies (UNC Eshelman School of Pharmacy, 2017, EII Microincubator; University of Illinois, n.d.).

STARTUP ACCELERATORS, FELLOWSHIP PROGRAMS, TRAINING PROGRAMS, NATIONAL SCIENCE FOUNDATION I-CORPS, AND WORK EXPERIENCE

In support of entrepreneurial education, many universities provide a wide variety of training programs for their students. These include:

- Nationwide NSF I-Corps programs, which focus on commercializing technology that was supported by the NSF (UCLA Anderson School of Management, n.d., NSF Innovation Corps Site at UCLA; National Science Foundation, n.d.),
- Short-term study-abroad programs looking at how mass production occurs in China (Martin Trust Center for MIT Entrepreneurship, n.d., Initiatives),
- Accelerator programs that transform early stage startups into fundable companies (University of California, Berkeley, 2017, Launch; University of California, Berkeley, 2017, Skydeck; Citris Foundry, 2017),
- Pre-accelerator programs that connect clinicians with great ideas to resources to design software solutions for patient care (The Johns Hopkins University, n.d.),
- Programs that build leadership skills in healthcare executives (UCLA Anderson School of Management, n.d., UCLA/Johnson & Johnson Health Care Executive Program), and
- Programs that provide resources to students looking to buy a business (Rice University, 2017).

Semester-long consulting projects for emerging companies (InSITE Fellows, 2016), marketplaces that match students to startups (University of California, Berkeley Haas School of Business, 2015, Startup Marketplace Matches MBA Students & UCSF Scientists), and entrepreneurship internships provide real work experience for students.

TABLE 2: FUNDING

BERKELEY

Through an application process, ten students with early stage start ups are awarded every six months \$5000 in seed funding from the Dean's startup fund (University of California, Berkeley Haas School of Business, 2015, Berkeley-Haas Startup Seed Funding).

MIT

There are various grants, including Deshpande Center Ignition and Innovation Grants to help students commercialize breakthrough technologies and inventions. The Legatum Centre Seed Grant helps students explore innovation-driven opportunities in the developing world. The Sandbox Innovation Fund provides seed funding of up to \$25,000 for student-initiated ideas. The Student Group Collaboration Grant encourages partnership between entrepreneurship-focused student groups (Martin Trust Center for MIT Entrepreneurship, n.d., Student groups, Competitions, Grants + Hacks).

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

The Eshelman Institute for Innovation awarded nearly \$9.4 million for 24 projects (out of 53 proposals) in its inaugural round of funding for innovative ideas submitted by faculty and staff at the UNC Eshelman School of Pharmacy. The institute was originally created by a \$100 million gift from alumnus Fred Eshelman in Dec 2014 (UNC Eshelman School of Pharmacy, 2017, Eshelman Institute for Innovation Awards \$9.4 Million to Fund First Round of Innovative Ideas).

CURRICULAR PRACTICES

COURSES

Many institutions provide formal entrepreneurship courses, whether introductory undergraduate courses or more advanced graduate electives, to provide a foundation for students. The scope and variety of curricula from Berkeley and University of Michigan are provided as examples in Table 3.

TABLE 3: EXAMPLE ENTREPRENEURSHIP CURRICULA AT OTHER INSTITUTIONS

Berkeley (University of California, Berkeley Haas School of Business, 2015)

- Social Impact Disco
- Social Entrepreneurship
- Life as an Entrepreneur
- Venture Capital Speaker Series
- Private Equity Speaker Series
- Social Impact Speaker Series
- Entrepreneurship
- Venture Capital and Private Equity
- Opportunity Recognition: Technology and Entrepreneurship in Silicon Valley
- New Venture Finance
- Entrepreneurship Workshop for Startups
- Business Model Innovation & Entrepreneurial Strategy
- Lean Launchpad
- The Startup Lab
- Social Lean Launchpad
- Introduction to Entrepreneurship
- Social Entrepreneurship
- Entrepreneurship
- Perspectives on Entrepreneurship
- Venture Capital, Private Equity and Hedge Funds – An Introduction

University of Michigan (University of Michigan, 2017)

- Entrepreneurial Business Basics
- Entrepreneurial Creativity
- Designing Practices
- Building Design Prototypes
- Working with Wood
- Working with Metal
- Change by Design
- Business Entrepreneurship in Thought & Action
- Social Media and the Changing Nature of Business Communications
- Economics of Entrepreneurship
- 1Mobile App Development for Entrepreneurs
- Problem Solving, Troubleshooting, Entrepreneurship, Intrapreneurship, and Making the Transition to the Workplace
- Entrepreneurial Business Fundamentals
- CleanTech Entrepreneurship

- High Tech Entrepreneurship
- Patent Fundamentals for Engineers
- Intro to Entrepreneurial Design
- E-Commerce Entrepreneurship
- Entrepreneurship Hour
- Patent Law
- Intro to Venture Capital
- Entrepreneurship Hour Discussion Session
- Finding Your Venture
- Entrepreneurial Marketing
- Urban Entrepreneurship
- Organizational Management in Startups (How to Build a Killer Team)
- Environmental Values in Public Policy
- Introduction to Entrepreneurship
- Entrepreneurship Management
- Family Business
- Introduction to Microfinance
- Managing the Growth of New Ventures
- Entrepreneurship
- Front-End Design
- Digital Marketing
- Innovation and New Product Development
- Creativity at Work
- Leadership and Collaboration
- Practicum in Leadership and Collaboration
- Psychology of Creativity
- Negotiations
- Startups and Upstarts: Psychology of Entrepreneurship and Intrapreneurship
- Urban and Community Studies
- Organizing People, Power, and Social Change
- Evaluation of Systems and Services
- Theories and Practice for Community Action and Social Change
- Introduction to Stage Management
- Global Community Practicum
- Performing Arts Management
- Creative Process
- Nonprofit Management Community
- Pedagogy of Empowerment: Activism in Race, Gender and Health
- Innovator’s Toolkit
- Entrepreneurship Practicum
- Advanced Entrepreneurship Practicum
- Starting Music Businesses
- Financing Technology Commercialization

FACULTY PRACTICES

REWARDING INNOVATION AND ENTREPRENEURSHIP

Awarding faculty “Innovator of the Year” boosts the emphasis on entrepreneurship both campus-wide and within a department. Beyond annual awards, tenure and promotion criteria have been updated to include innovation and entrepreneurship. At the University of Virginia School of Medicine, promotion and tenure is also based on patents, license agreements, copyright, and economic development impact (U.S. Department of Commerce, 2013). The feasibility of changing promotion and tenure criteria depends on the department. Another incentive is allowing faculty leave to pursue entrepreneurial activities without risk to their promotion or tenure (U.S. Department of Commerce, 2013).

FACULTY MENTORING AND LAW CLINICS

Faculty at various universities also provide their students with mentoring in entrepreneurship. At MIT and Rice, there are lists of entrepreneurship-affiliated faculty, which include directors of innovation as well as professors of basic sciences (Martin Trust Center for MIT Entrepreneurship, n.d. Affiliated Faculty; Rice University, 2015, Initiative Faculty and Leadership). These lists are valuable to students who are looking for entrepreneurial role models.

Another example of faculty giving entrepreneurial advice is the free law clinic Boston University faculty provide to MIT students. This clinic helps students with a variety of legal issues related to entrepreneurship, cyber law, and creating a business (Martin Trust Center for MIT Entrepreneurship, n.d. Entrepreneurs in Residence).

ENTREPRENEURIAL RESEARCH

Faculty showcase their published articles on entrepreneurship research at Stanford University (Stanford Graduate School of Business, n.d., Research Supported by the Center for Entrepreneurial Studies). These research articles can interest other faculty, as well as serve as a helpful resource to students.

PROMOTING COLLABORATION

Faculty participate in programs that provide training and promote entrepreneurial collaboration across and beyond the campus. The University of Cincinnati Research Institute is an example of a non-profit that allows faculty to partner with

local, national, and international industries. Since the foundation was created outside of the university, faculty can be compensated for their work through income from licensing revenues while staying compliant with state regulations (U.S. Department of Commerce, 2013). By collaborating with other parties outside of the institution, faculty can lead by example for their students.

STUDENT PRACTICES

STUDENT OR ALUMNI GROUPS

Students at many of the institutions who are supportive of entrepreneurship have formed their own groups, whether to network with other students (Berkeley Entrepreneurs Association, n.d.; Martin Trust Center for MIT Entrepreneurship, n.d., Student groups, Competitions, Grants + Hacks), alumni in a specific field such as venture capital industry (Berkeley Haas Venture Fellows, n.d.), or entrepreneurs in the larger community (Purdue University, 2016).

COMPETITIONS

Students often become very energized about entrepreneurship when participating in competitions. Examples of successful competitions include: Global Social Venture Competitions (University of California, Berkeley Haas School of Business, 2017), Clean Energy Prizes, Creative Arts Competitions, and Inclusive Innovation Competitions (Martin Trust Center for MIT Entrepreneurship, n.d., Student groups, Competitions, Grants + Hacks).

At the University of Utah, the Bench 2 Bedside competition is a good exercise for students to work in teams to identify unmet clinical needs, and develop medical device ideas and business plans which address these needs (The University of Utah, n.d.).

MENTORING

Students look beyond the university to seek mentorship from venture capitalists, attorneys, and professional advisors, as seen at Berkeley and MIT (University of California, Berkeley Haas School of Business, 2015, Berkeley-Haas Entrepreneurship Mentoring Hours).

FORUMS, WORKSHOPS, AND ONLINE DISCUSSIONS

Students participate in and develop their own forums and workshops on entrepreneurship. These forums and workshops

not only educate, but also provide students an opportunity to network with other peers as well as guests from outside the institution (University of California, Berkeley Haas School of Business, 2015, Berkeley Entrepreneurs Forum; Martin Trust Center for MIT Entrepreneurship, n.d., Additional Resources).

Students also actively engage in online idea-sharing platforms, and use these platforms to connect with other students and faculty (Martin Trust Center for MIT Entrepreneurship, n.d., Additional Resources). These online platforms are often very resourceful, containing videos, articles, and podcasts related to entrepreneurship (Martin Trust Center for MIT Entrepreneurship, n.d., Entrepreneurship Educators Forum (EEF); Stanford School of Engineering, n.d.).

COMMUNITY-BASED PRACTICES

Universities have also focused on helping economic development in their surrounding communities. At University of Georgia, enhanced courses integrate service learning opportunities in their local communities (U.S. Department of Commerce, 2013). At University of Kansas, graduate students and alumni provide mentorship to struggling local businesses (U.S. Department of Commerce, 2013).

In this section, we have shared many examples of entrepreneurial programs in higher education. However, we also need to take caution, because not all programs will always be of high quality. In every entrepreneurial activity we design, we need to think carefully about:

1. How will this benefit our student?
2. How will this benefit our faculty?
3. How will this benefit our institution?
4. How will this benefit our local community and society as a whole?

RECOMMENDATIONS FOR UMB

Based on our research, we have developed a set of recommendations to bring UMB innovation and entrepreneurship in line with its strategic goals.

As a graduate and professional university, UMB holds a unique opportunity to create an interdisciplinary and interprofessional entrepreneurial ecosystem on campus and throughout the West Baltimore community. Many times,

other institutions have added entrepreneurship programming to existing University structure without a focus on integration. This has resulted in a disconnected and sometimes redundant ecosystem. At UMB, we have a great opportunity to integrate and align each facet of our burgeoning entrepreneurial ecosystem. In addition, due to the increase in funding resulting from the strategic partnership between UMB and UMCP, there are opportunities for many new initiatives. Taken together, we believe this can accelerate the development of a culture of innovation at the university.

Our overarching recommendation is for UMB to foster a culture of entrepreneurship and innovation. New initiatives have already begun and are referred to. Ideally, coordination of each recommendation will provide the best results.

The following specific recommendations are designed to achieve this larger goal.

INSTITUTIONAL RECOMMENDATIONS

CENTRALIZE UMB ENTREPRENEURIAL EFFORT

We believe this is the most crucial issue. As illustrated throughout the paper, myriad entrepreneurial initiatives are underway at UMB. However, many of these programs that could benefit all students, or could benefit from collaboration with other schools, are effectively siloed within their own school. After our research, we found that many key entrepreneurial influencers at UMB had limited to no knowledge of what other initiatives were underway.

We recommend that a standing UMB Entrepreneurship and Innovation Strategy Working Group be formed to discuss and coordinate all entrepreneurial activities at UMB. The committee will be formed by key stakeholders from staff, faculty, administration, and students, and will meet regularly. EIN has taken the first steps toward centralizing UMB's entrepreneurial effort by hosting the UMB Entrepreneurship and Innovation Expo. This proposed yearly event is designed to showcase current UMB faculty and student entrepreneurship, and to have substantive collaborative dialogue.

Centralizing UMB efforts will be advantageous for several reasons. First, communication will lead to improved programming and increased student outreach. Second, collaboration among groups will promote the interdisciplinary environment UMB values so highly. Third, initiatives will not reinvent existing ones and or duplicate others underway, saving valuable time and resources.

SEED FUNDING

Seed funding appears crucial to UMB student entrepreneurs. Our survey data indicate that 42% of students find seed funding to be extremely important when considering their needs as student innovators. Twenty-nine percent of students find it very important, compared to 2% of students who find it not important at all (fig. 6). This funding is equally important for faculty entrepreneurs.

Thus, we suggest that the University provide seed funding to UMB startup companies. Small seed funds should be available for concepts that are in their early exploratory stages with high potential. Larger sums should be available for concepts further along in the commercialization process. Additionally, the University should designate separate funds for student and faculty-led projects.

In addition to seed funding for active students, we recommend that UMB assist students with entrepreneurial careers. For students who have created their own UMB spinout companies, graduation poses a financial dilemma. Since companies are typically not generating revenue and have not received funding, there may be confusion as to whether or not the student should apply for jobs to make a living, or continue to grow their company without financial stability. By providing monetary support for up to one year, UMB can provide graduated student entrepreneurs some stability, and the rare opportunity to build their company financially unencumbered.

These funds are currently in development through the ORD. We suggest UMB actively promote the seed funding programs, so that the UMB community knows they are available and feels their entrepreneurial endeavors are financially supported. Furthermore, we recommend UMB more effectively communicate state and federal entrepreneurial funding opportunities and streamline their application processes for faculty and students.

INCUBATOR AND CO-WORKING SPACES

Students want a distinct space in which they can innovate. Thirty-six percent of students find some combination of a co-working space or incubator extremely important. Twenty-four percent find it very important. Only 4% of students find it not important at all (fig. 6).

Typically these spaces include a variety of resources that accelerate innovation. Thirty-five percent of students responded that design and prototyping resources are extremely important, while 43% feel the same about access to market research tools.

We recommend that UMB establish a startup incubator to facilitate the transformation of innovative ideas into fundable companies. Teams can be built around existing university technologies, or around new innovations from students and faculty who desire to form companies. The incubator can house UMB spinout companies and provide resources such as wet lab space, offices, and business advice. The I3 incubator, mostly focused on data analytics, has recently formed on campus. They are planning to move into a new location in the Health Sciences and Human Services Library, which already provides design resources. Additionally, the New Ventures program from OTT works to spin out UMB companies with the inventor as a co-founder.

Furthermore, we recommend that UMB provide students and faculty with a shared working space outside of their typical work environments in order to promote interdisciplinary innovation. A co-working space can function as the cultural center of the UMB entrepreneurial ecosystem. It can serve as a space for student and alumni groups to meet, for students to get together to generate new ideas, and for workshops and extracurricular educational activities. The spaces can offer resources like the design and prototyping tools and databases desired by students.

Multiple co-working space and incubator hybrids are being planned. Both the School of Medicine and the School of Pharmacy are planning spaces in their respective buildings designed to encourage innovation among their students. Additionally, a large co-working space in the Lions Brothers building near the BioPark is in development and will be open to all UMB students and the West Baltimore community. The same space will house UM Ventures companies. We recommend each incubator and co-working space communicate and collaborate on programming and resources so as not to duplicate efforts.

CURRICULAR RECOMMENDATIONS

COURSEWORK

We recommend an expansion of entrepreneurship-related coursework, and suggest that UMB make it available to both students and faculty. It would be beneficial to allow UMB students to access resources and courses at the University of Maryland Smith School of Business, which already has a location in the BioPark. For students more dedicated to careers in entrepreneurship, UMB should create certificate programs that require coursework and experiential learning, ultimately rewarding the student with a certificate in entrepreneurship.

Integrating this coursework into existing school curricula will allow students the time and encouragement to innovate and pursue alternative careers. When surveyed, 20% of students find for-credit business courses extremely important and 25% find them very important. However, a combined 34% of students find the same courses only slightly important or not important at all (fig. 6).

Currently, multiple certificate programs, as well as the means to fund them, are being pursued in the medical and graduate schools. These initiatives should be combined, streamlined and encouraged to fit into all UMB professional programs.

FELLOWSHIP PROGRAM

The University should provide highly motivated student entrepreneurs with an intensive fellowship program. This fellowship could lead students through the development process of a university technology or an idea of their own, and be supplemented with active mentorship and coursework. The President's Entrepreneurship Fellowship already does this successfully, but UMB should increase cohort size, length of the fellowship, and expand to allow students to pursue their own innovations. Additionally, professional school students should be compensated for their time, and graduate school PI's should be compensated for their students' time out of the lab, through stipend support.

FACULTY RECOMMENDATIONS

INCREASE FACULTY ENTREPRENEURSHIP

If we are to change the culture at UMB, we believe increasing faculty entrepreneurship is essential. UMB should educate faculty on alternative funding or scientific opportunities, and

promote them when they become available. This is especially pertinent in today's funding climate, where grants are becoming harder to attain and renew. Faculty entrepreneurship mentors are also essential. Most faculty are unfamiliar with the concept of nontraditional funding and entrepreneurship, and so are understandably fearful to step outside of their comfort zone. Advice and guidance from experienced faculty entrepreneurs can alleviate these concerns.

Currently, there is less incentive in terms of career advancement for faculty who undertake entrepreneurial endeavors when compared to faculty pursuing traditional methods. Therefore, we recommend that faculty entrepreneurship be tied to promotion and tenure in the same way as publications and grants.

Increasing the entrepreneurial spirit among faculty will ultimately benefit their students and the UMB community.

STUDENT RECOMMENDATIONS

MENTORSHIP

Students overwhelmingly acknowledge the need for increased opportunities to receive mentorship, especially in the entrepreneurial setting. Forty-five percent of students surveyed find mentorship extremely important, followed by 29% finding it very important, when considering their needs as student innovators. Furthermore, a majority of students consider recurring entrepreneurial office hours moderately important to extremely important (fig. 6).

We suggest that UMB facilitate mentor mentee relationships with budding student or faculty entrepreneurs and current UMB entrepreneurs or experts. It would be beneficial to collaborate with existing entrepreneurship office hours at the Institute of Marine & Environmental Technology, or to establish UMB's own, possibly led by the OTT. Increased visibility and accessibility of the OTT throughout the university would benefit students, allowing them to more easily receive feedback on ideas and inventions. Furthermore, we suggest that UMB actively connect with the greater Baltimore entrepreneurial community.

STUDENT AND ALUMNI GROUPS

We recommend that the University promote student and alumni involvement in the UMB entrepreneurial community.

UMB should bring successful alumni entrepreneurs back to act as mentors to students. The University should also allow student groups to speak for the student body in regards to their needs as innovators and entrepreneurs. Student groups have already sprung up in response to their unmet entrepreneurial needs, and the University should allow them to maintain their voice.

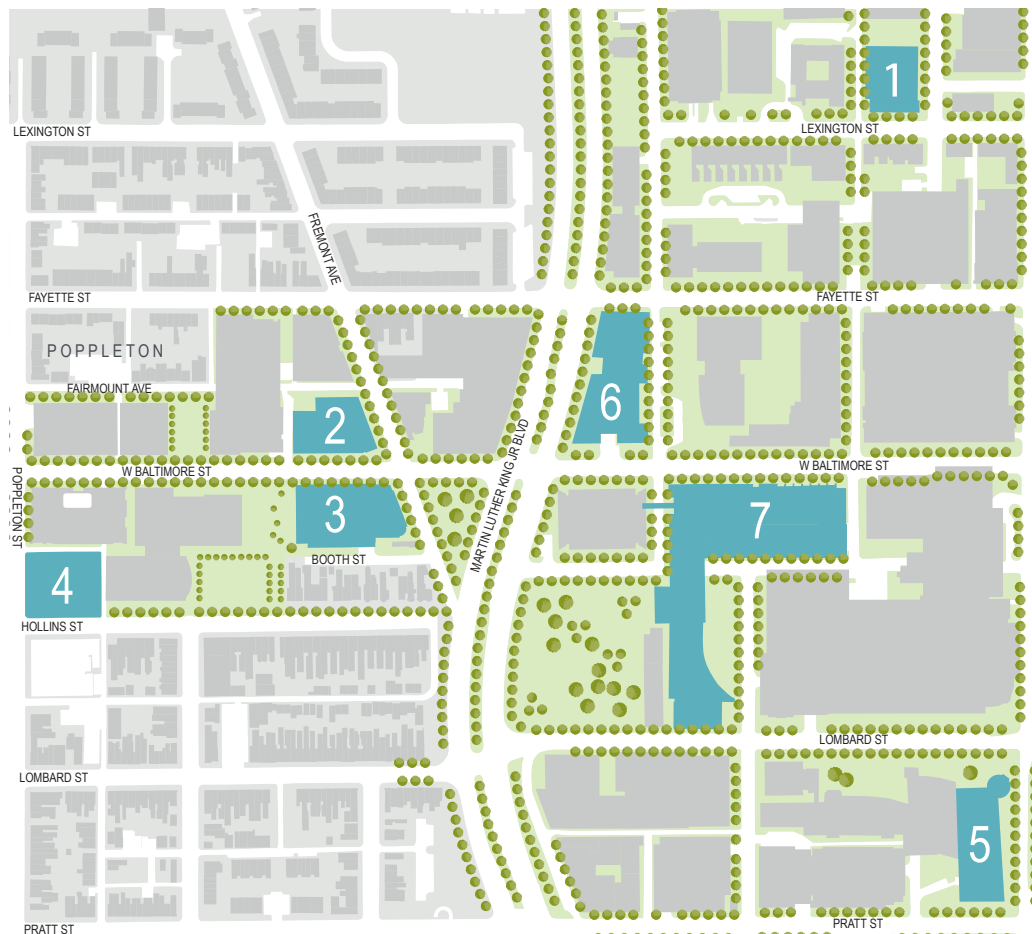
COMPETITIONS AND HACKATHONS

Increased competitions and hackathons will promote entrepreneurship throughout the campus and provide students with valuable experience. Seventeen percent of students surveyed say competitions are extremely important when considering their needs as student innovators. Twenty-three percent find it very important (fig. 6). The School of Medicine and School of Pharmacy currently hold pitching and business plan competitions. Increased prize money or rewards for winning the competition should be considered.

COMMUNITY-BASED RECOMMENDATIONS

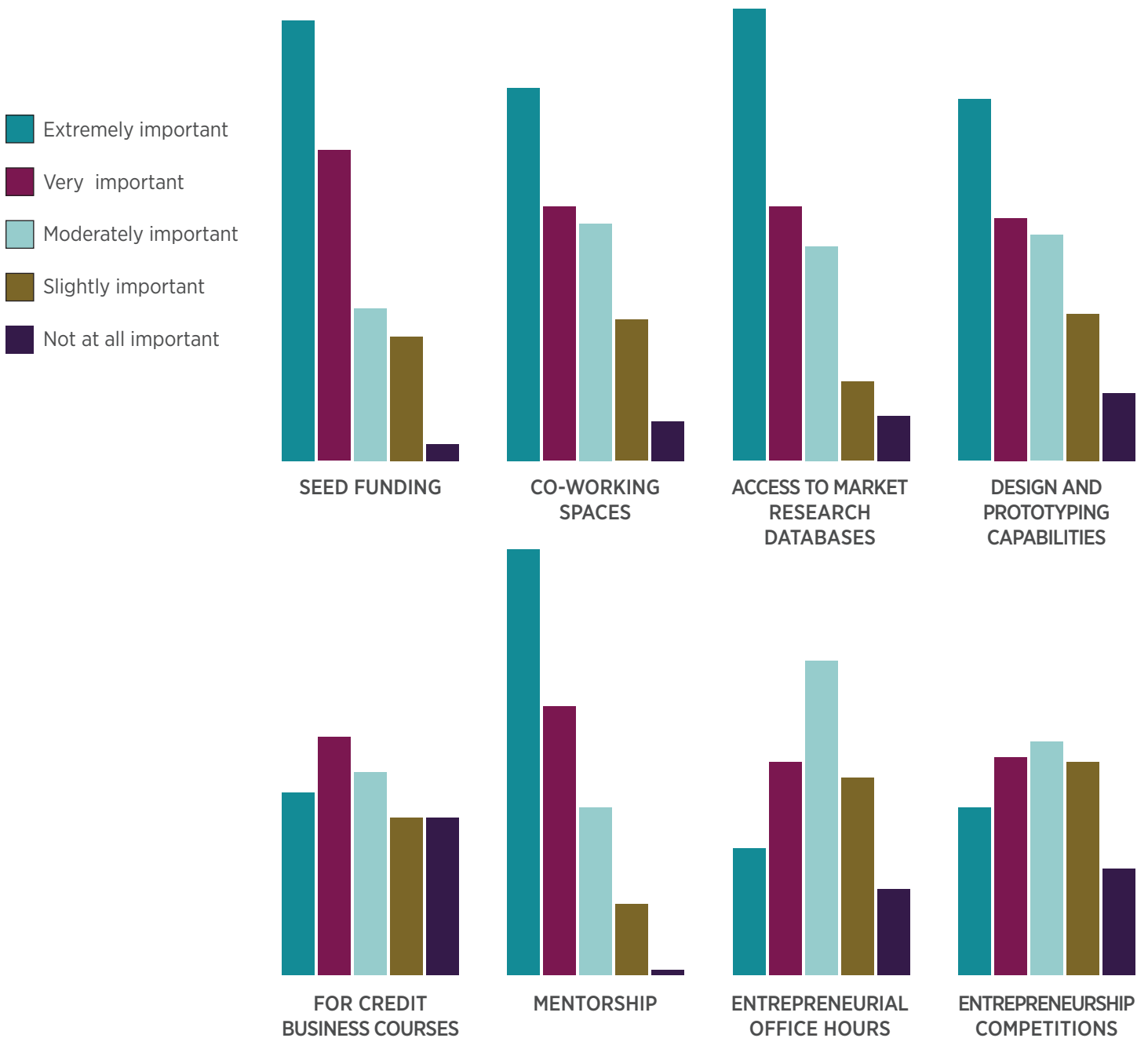
Many responses to our open answer section of the survey addressed the need for UMB to think of entrepreneurship more broadly and include a social perspective. We recommend that UMB encourage students with an entrepreneurial spirit to take on social challenges, and work to create sustainable solutions that may result in economic gain for the greater Baltimore community. If students, faculty, and staff can join forces with other organizations and agencies in Baltimore City, they can use that synergy to collectively leverage a mixed pool of talents to integrate into the community. We believe that the scope of this current report could not include all aspects of “social entrepreneurship,” and recommend that this topic receive a White Paper report of its own in the future.

CURRENT AND PROJECTED INNOVATION SPACES ON UMB'S CAMPUS



1. ORD/OTT Lexington Building
2. University of Maryland Biopark
3. University of Maryland Biopark
4. Lions Brothers Building
5. Health Sciences & Human Services Library (HS/HSL)
6. Pharmacy Hall
7. Health Sciences Facility

FIGURE 6: THE NEEDS OF STUDENT ENTREPRENEURS



The world is shifting rapidly before our eyes, and so is our city. Students at UMB will benefit from learning an entrepreneurial mindset that allows them to adapt to this ever-changing landscape and generate solutions that fit. Building their capacity to define a problem, listen closely for insights, and test solutions will be relevant in any professional context.

Michelle Geiss, MPH
Co-Founder and Executive Director, Impact Hub Baltimore

FIGURE 7: INDUSTRIES FOR ENTREPRENEURS



I&E [Innovation & Entrepreneurship] is not limited to the idea of starting companies. We aim to teach innovation methods and cultivate entrepreneurial mindsets to prepare all students to tackle our world's big challenges whether they're at startup companies, large companies, non-profits, the public sector, or anywhere else.

Dean Chang, PhD

Associate Vice President for Innovation & Entrepreneurship, University of Maryland College Park

THE PRESIDENT'S FELLOWS 2017



ANNA HUNG



BENJAMIN PORTNEY



CHINONYE DONNA
EGBULEM



CAMILO VANEGAS

ANNA HUNG **SCHOOL OF PHARMACY**

Anna Hung, PharmD, is a PhD candidate in the Pharmaceutical Health Services Research (PHSR) graduate program at the University of Maryland School of Pharmacy. Anna received her B.S. in Microbiology from the University of Maryland and Pharm.D. from the University of Maryland, School of Pharmacy. She has research experience with the Center for Advanced Research in Biotechnology, University of Maryland Gemstone Honors Program, University of Maryland School of Medicine Health Professions- Student Training in Aging Research Program, and World Health Organization. She was selected for the Academy of Managed Care Pharmacy (AMCP)/Foundation of Managed Care Pharmacy (FMCP)/Pfizer internship and FMCP/Allergan internship two years in a row. She has further managed care and industry experience from the Department of Defense Pharmacoeconomic Center, Biotechnology Industry Organization, and Blue Cross Blue Shield Association. In the School of Pharmacy she serves as a mentor for the Phi Lambda Sigma Leadership Society, member of the Assessment Committee, Ambassador for the Pharmacy Quality Alliance, President of the International Society for Pharmacoeconomics and Outcomes Research student chapter, and research assistant for Professor C. Daniel Mullins. Her research interests include pharmacoeconomics, comparative effectiveness research, and patient-centered outcomes research.

BENJAMIN PORTNEY **GRADUATE SCHOOL, BIOCHEMISTRY** **& MOLECULAR BIOLOGY**

Benjamin Portney is a Ph.D. candidate in the Department of Biochemistry and Molecular Biology at the University of Maryland School of Medicine where he studies cellular immortality and the role of the embryonic gene pathways in cancer. Ben is also interested in adult stem cell biology and its applications in regenerative medicine. When not busy in the lab, Ben is passionate about entrepreneurship and commercializing new and innovative technologies.

CHINONYE DONNA EGBULEM **SCHOOL OF SOCIAL WORK** **& SCHOOL OF MEDICINE (PUBLIC HEALTH)**

Chinonye Donna Egbulem is a research consultant and aspiring entrepreneur with over 5 years of experience in global health and development policy research. She is in her final year of the MSW/MPH dual degree program at UMB. She has worked collaboratively on national and international-level projects to contribute to capacity-building training and technical assistance projects. Prior to graduate school, she served in the Peace Corps as a Community Health Development Agent in Burkina Faso. Her academic and community work have focused on reducing health disparities, improving access to maternal and child health care among transient populations, and decreasing violence in Baltimore City. She has a keen interest in fortifying public health infrastructures by explicitly linking and aligning health care delivery systems with community resources and social services.

CAMILO VANEGAS **GRADUATE SCHOOL, MOLECULAR MEDICINE**

Camilo Vanegas grew up in Columbia, Maryland and attended the ARL Biotechnology Career Academy which forever changed his outlook on science. He continued to pursue and explore his passions in multiple laboratories at the University of Maryland, College Park (UMCP) and graduated with a BS in Kinesiology. While attending UMCP he fell in love with improving the human condition and decided to attend the University of Maryland school of Medicine, Graduate Program in Life Sciences. He is currently a 4th year PhD candidate in the Molecular Medicine program working on understanding the mechanisms behind skeletal muscle movement with regards to calcium channels and interacting proteins. Camilo hopes to one day make biology as ubiquitous and user-friendly as an iPhone so that anyone can enjoy its beauty.

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FINAL THOUGHTS

The business entrepreneur is a very special kind of achiever. According to David C. McClellan of Harvard's Dept. of social Relations, s/he is "more concerned with achieving success than with avoiding failure. S/he sees the world as neither benevolent nor malign, but neutral, and s/he never doubts his/her power to hold his/her own in the marketplace. S/he is readily bored by routine as s/he is challenged by risk taking – and s/he knows how to reckon the odds. Such a person is obviously valuable to any economy, but s/he is also rare.

J.C. Weiss, MBA

Executive-in-Residence for Finance, University of Baltimore

Graduate studies today would be incomplete without the offering of entrepreneurial educational opportunities. To that end, universities must acknowledge that successful entrepreneurship training is more than just what's taught in a classroom. It requires a culture shift at every level such that students feel empowered and supported in their journey to include entrepreneurship into their training and careers."

Suzanne Clough, MD

Former University of Maryland, Baltimore medical student, resident, and faculty, as well as co-founder and former Chief Medical Officer of WellDoc



