



UNIVERSITY OF MARYLAND  
STRATEGIC PARTNERSHIP  
**MPOWERING THE STATE**

## **CMAV AND UMCEED ANNUAL REPORTS**

### **University of Maryland Strategic Partnership**

The University of Maryland Strategic Partnership Act of 2016 codified an alliance between the University of Maryland, Baltimore and the University of Maryland, College Park, known as *MPowering the State* or *MPower*. The law strengthened the partnership, outlined a series of charges to the universities, and created two new centers: the Center for Maryland Advanced Ventures (CMAV) and the University of Maryland Center for Economic and Entrepreneurship Development (UMCEED).

**This document shares the Fiscal Year 2022 reports on the progress and activities of the two centers.**

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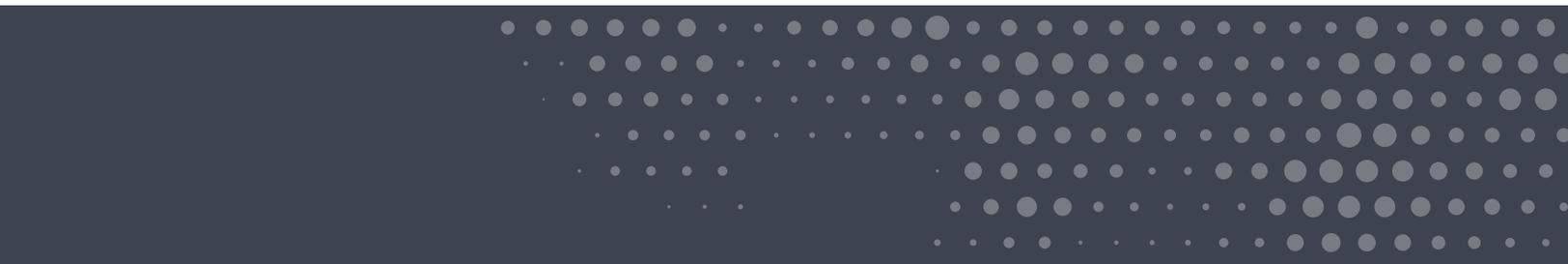
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For more information about the partnership and its activities, please visit the [MPower website](#); to view past fiscal year reports, please contact Adrienne Arthur, Executive Director and Assistant Vice Provost, [aarthur@umaryland.edu](mailto:aarthur@umaryland.edu).



CENTER FOR  
MARYLAND  
**ADVANCED  
VENTURES**

FY2022 REPORT



## Overview

The Center for Maryland Advanced Ventures (CMAV) facilitates technology transfer for UM Ventures and amplifies the impact of university-based research. Strategic initiatives help identify research projects with strong commercial potential while providing programming that supports the advancement of technology commercialization. The initiatives are designed to integrate and work collaboratively with existing offerings from UM Ventures, TEDCO, and the Maryland Department of Commerce.



*James L. Hughes, MBA*

CMAV is directed by Jim Hughes, senior vice president and chief enterprise and economic development officer at University of Maryland, Baltimore (UMB).

## History

Located on the UMB campus, CMAV was created and funded through the University of Maryland Strategic Partnership Act of 2016 and launched on July 1, 2017. The legislation provides \$4 million annually to strengthen the commercialization of high-potential, university-based discoveries. Due to the success of the program, in FY2022, the legislature increased funding for CMAV by \$2.5 million annually. Starting in FY2023, the program will operate with \$6.5 million each year.

## In Action

CMAV funds entrepreneurial staff, grants to startups and growing companies, program costs for promoting technology commercialization, matching support for faculty projects with high potential, student activities and experiences, outreach to the greater Baltimore scientific community, development of intellectual property, and assistance for small business formation. Throughout FY2022, the CMAV team focused on broadening outreach and developing additional programs that support emerging technologies and current areas of need. The following report illustrates the impact of CMAV funding, detailing annual and cumulative achievements of the programs supported by CMAV.



FY2022

**PROGRAM  
ACTIVITIES**



## MARYLAND MOMENTUM FUND

### FY2022 ACCOMPLISHMENTS

**\$2.5M**  
INVESTED

**6** INVESTMENTS IN  
NEW COMPANIES

**6** INVESTMENTS IN  
EXISTING COMPANIES

A collaboration between UM Ventures and the University System of Maryland (USM), the Maryland Momentum Fund (MMF) is an early-stage investment fund that invests in Maryland-based, USM-affiliated startup companies.

To enhance the early success seen since the inception of MMF, in FY2022 the Board of Regents provided an additional \$6 million in funding, taking the MMF from a \$10 million fund to a \$16 million fund. Investments from USM Institutions are projected to bring the total size of the MMF to over \$21 million.

CMAV funds a full-time Managing Director based at UMB and provides additional support and operational expenses. The MMF staff conduct outreach at all USM institutions, soliciting applications for funding and providing advice and support to entrepreneurs across USM.

### LIFETIME PORTFOLIO ACCOMPLISHMENTS

**\$10.6M**  
INVESTED

**28** PORTFOLIO  
COMPANIES

**8** USM  
INSTITUTIONS

**\$91.1M**  
MATCHED

**150+** UNIQUE  
CO-INVESTORS

**140** NEW JOBS  
CREATED

## PRESIDENT'S ENTREPRENEURIAL FELLOWSHIP

To enhance entrepreneurial education, the President's Entrepreneurial Fellowship program provides UMB and University of Maryland, College Park (UMCP) Robert H. Smith School of Business MBA students the opportunity to learn first-hand the unique challenges of commercializing life science technologies. Mentored by UM Ventures staff, the Fellows work on interdisciplinary teams to commercialize UMB-owned technologies.

In FY2022, five fellows, representing the School of Pharmacy, School of Dentistry, and the Robert H. Smith School of Business, were joined by two volunteer fellows from the previous year who were interested in an extended experience. The Fellows investigated companies focused on the tumor microenvironment and metastatic disease. They also worked under the mentorship of the Broth Agency, an advertising company which specializes in early life science company advising, on a project to develop a name for a new product being launched by a MMF portfolio company.

## GRADUATE RESEARCH INNOVATION DISTRICT

### FY2022 ACCOMPLISHMENTS

**15** STUDENT TEAMS  
FOR GRID PITCH

**40** WORKSHOPS

**1K** PARTICIPANTS

The Grid, located in UMB's Health Sciences and Human Services Library (HS/HSL), has continued to expand its programming to provide entrepreneurial resources and education to students, faculty, staff, and the community.

The Grid Pitch showcase welcomed 15 student teams and a total of 25 students, making it the largest applicant pool and accepted teams to date. It was hosted in-person for the first time since 2019, and more than 65 individuals from across UMB, Baltimore, and greater Maryland joined to celebrate student entrepreneurship.

The Grid's virtual student incubator now works with six student companies in total. The Student Social Venture Fund also awarded two more students \$2,500 and \$5,000 seed grants to support their social impact ventures. These grants represent the first phase of a greater investment in early-stage social entrepreneurship by individual and institutional donors in Baltimore and beyond.



## SMALL BUSINESS DEVELOPMENT CENTER

### FY2022 ACCOMPLISHMENTS

**483** CLIENTS  
COUNSELED

**639** JOBS CREATED  
OR RETAINED

**35** NEW  
BUSINESSES  
STARTED

**\$5.87M** LOANS AND CAPITAL INFUSION  
INTO BALTIMORE CITY BUSINESSES

The Small Business Development Center, the Federal small business outreach entity, is supported with funding and space at UMB. The office provides direct assistance to local and University-affiliated entrepreneurs from a wide array of business sectors.

## INTELLECTUAL PROPERTY LAW AND ENTREPRENEURSHIP CLINIC

### FY2022 ACCOMPLISHMENTS

**26** STUDENTS  
ENGAGED

**86** CLIENTS  
SERVED

**37** MINORITY OWNED/CO-OWNED  
35 FEMALE OWNED

**19** PATENT APPLICATIONS  
SUBMITTED

**7** TRADEMARK  
APPLICATIONS  
FILED

**19** TRADEMARK  
APPLICATIONS  
ISSUED

**56** OTHER USPTO FILINGS  
FOR PENDING TRADEMARK  
APPLICATIONS

**9** NEW MARYLAND LIMITED LIABILITY  
CORPORATIONS FORMED

The Francis King Carey School of Law Intellectual Property Law and Entrepreneurship Clinic (IPEC) provides second- and third-year law students with valuable work experience. Under the supervision of professors and with the support of two part-time clinical law instructors, students work with clients from UMB and the region to provide general counsel on basic business law, protect trade secrets, prepare nondisclosure agreements, and assist with company formation.

In Fall 2021, IPEC introduced a formal Business Law Track which enhanced the number and scope of services provided to clients, including drafting non-disclosure agreements, LLC operating agreements, and creating privacy policy statements for electronic communications.

## BALTIMORE FUND

The Baltimore Fund encourages University-created or -sponsored technology companies to locate and expand in Baltimore City as specified in the legislation. CMAV funds the Director of the Baltimore Fund and all expenses of the program. In addition to managing the program, the Director facilitates engagement with Maryland's entrepreneurial ecosystem and its myriad support programs and resources including TEDCO, Baltimore Development Corporation, and the Maryland Department of Commerce. The Baltimore Fund is open to all Maryland public higher education institutions and is administered by UMB.

Since the Fund's creation:

- Baltimore Fund portfolio companies have raised over \$10 million in investment and have sales exceeding \$25 million.
- Awards have supported companies representing seven Maryland public higher education institutions and a wide array of technologies.
- Grants to Morgan State University, UMCP, UMB and IMET have directly supported their entrepreneurial activities in Baltimore City and increased outreach to diverse populations.

FY2022 activities included:

- Awards to five companies: Next Step Robotics, JuneBrain, RemBac, NAWEC, and Astek Diagnostics.
- Supporting nine new vendors in Lexington Market by providing a loan loss reserve to Baltimore Community Lending's targeted microloan program.
- Supporting the expansion of UMCP's I-Corps program in Baltimore City at Morgan, Coppin, and University of Baltimore.
- Investing in UpSurge, an organization focused on building Baltimore's knowledge economy and reputation as a top tier innovation city. Their vision is to make Baltimore the country's first Equitech city—a diverse and inclusive innovation community.

## LIFETIME ACCOMPLISHMENTS

**62** ENTITIES ASSISTED

**640+** JOBS CREATED OR RETAINED

**14** NEW LEASE SUBSIDIES

**19** COMPANY EXPANSION AND RELOCATION GRANTS



FY2022

**GRANT  
ACTIVITIES**



## GRANT APPLICATIONS

The legislation encourages the support of external grants to support and enhance CMAV activities. UMB submitted and participated in a number of grant applications to support the University's translational research and the growth of Baltimore's innovation ecosystem.

In addition to the direct commercialization grants mentioned in other parts of this report, the following grants were submitted and directly enhance CMAV funding, programming, and activities.

### FY2022 Grant Applications

- U.S. Economic Development Administration's (EDA) Build Back Better Regional Challenge
- National Science Foundation's Civic Innovation Challenge
- Department of Defense National Security Innovation Network
- EDA University Center I-Corps Grant
- EDA Chesapeake Digital Health Exchange
- UMB Institute for Clinical & Translational Research
- Maryland Department of Commerce Anchor Ventures Sponsorship
- Maryland Department of Housing and Community Development SEED grant

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## DOD NATIONAL SECURITY INNOVATION NETWORK

DoD's National Security Innovation Network (NSIN) Emerge Accelerator is a pilot program that seeks to establish partnerships with universities to develop technologies that target both government and commercial use. Funding is intended to accelerate technology development and venture formation.

UMB's application focused on 10 existing technologies that highlight our clinical and research expertise in trauma care and training, vaccine and adjuvant development, and radiation treatment. We were one of 25 universities selected for further review. Each submitted technology received a strategic analysis of their proposed IP opportunities.

One UMB technology, a trans-esophageal aortic blood flow occluder, developed by Dr. Joseph Rabin from the UMSOM Department of Surgery, was selected for full participation. Dr Rabin and his team received assistance with identifying and marketing to military collaborators and customers as well as with the creation of a well-developed pitch deck.

## **ANCHOR VENTURES**

### **FY2022 ACCOMPLISHMENTS**

**4** PROGRAMMED EVENTS

**300** LIVE ATTENDEES

Anchor Ventures harnesses the collective expertise and influence of local universities, key stakeholders, entrepreneurs, and investors to foster collaboration between and the education of Baltimore's innovation ecosystem. Led by staff from UMB and Johns Hopkins University, Anchor Ventures provided four programmed events in FY2022 and collaborated with TEDCO and Chesapeake DHX. A grant from the Maryland Department of Commerce helped support activities this year. Topics included a reverse pitch focused on innovative digital health technology, cell and gene therapy technologies and applications, advice and stories from successful student entrepreneurs, and a digital health pitch competition. Programming for FY2023 is anticipated to expand with opportunities for in person events.



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## **MARYLAND DHCD SEED GRANTS**

UMB was awarded a third SEED grant from the Maryland Department of Housing and Community Development (DHCD) to support the development of entrepreneurial infrastructure in West Baltimore, bringing the total award to \$2.25 million. The grant awards provide funding to off-set the development of flexible lab and innovation spaces in 4MLK, the UM BioPark's new 250,000 sq. ft. mixed-use building. 4MLK is anticipated to open in summer 2024.

Innovation Hall, one of the supported initiatives, will provide civic innovation spaces—places where companies of all sizes, stages, and industries can build their businesses and connect with one another, anchor institutions, and other regional entities. Wexford Science & Technology, the developer of 4MLK, is providing the matching funds for the award.

FY2022

# TECHNOLOGY COMMERCIALIZATION

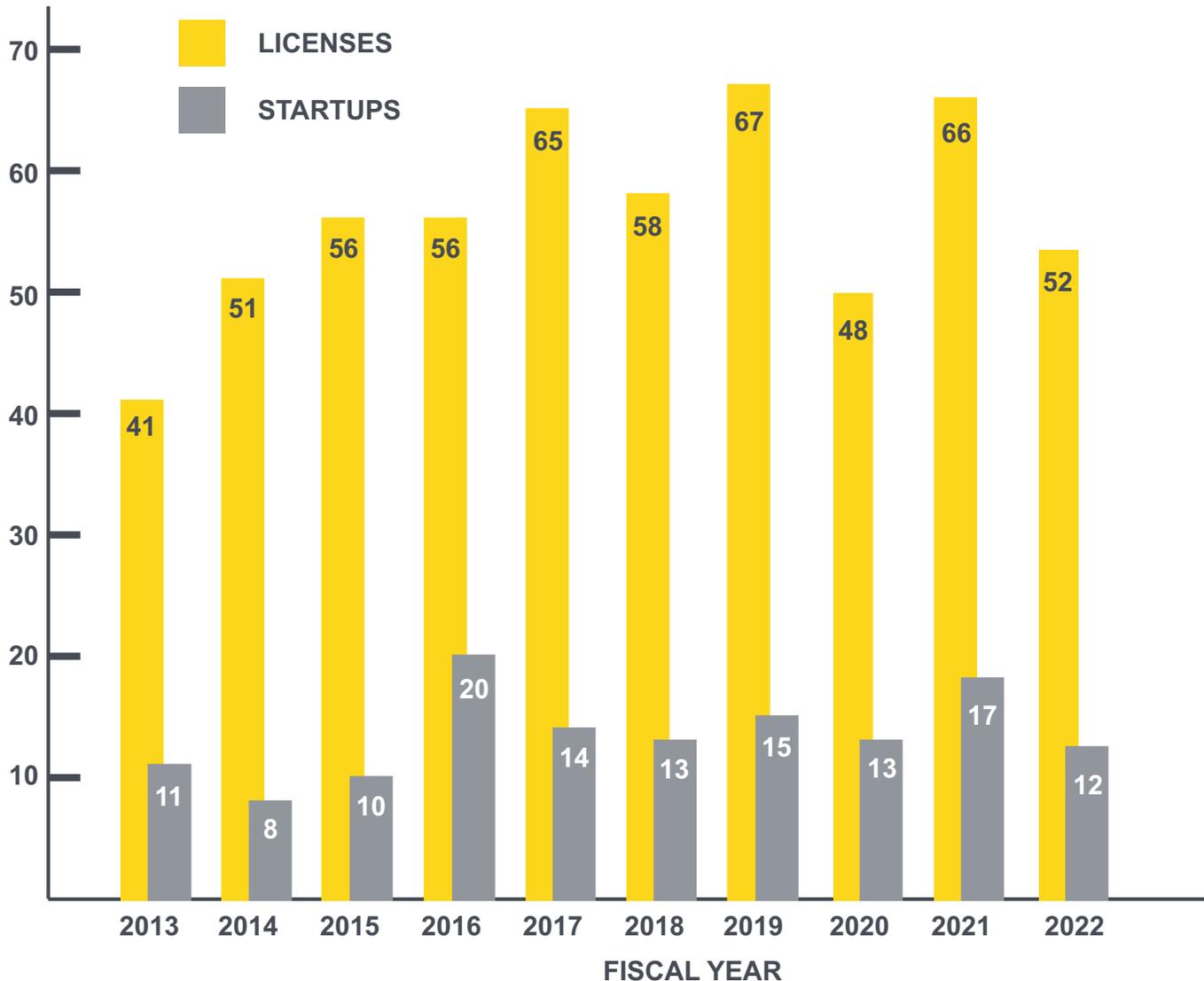


## UM VENTURES

Since the inception of UM Ventures in 2012, there has been a dramatic increase in technology transfer activities at both UMB and UMCP. The 10-year trend is reflected in the following graphic.

In FY2022, UM Ventures recorded 308 new disclosures, 50 licenses, and created 12 new startups. In addition, six new products made it to market, 79 patent applications were filed, and 85 patents were issued.

Through the concerted efforts of UM Ventures staff, strategic industry partnerships have been strengthened and the startup portfolio includes more high-profile startups.



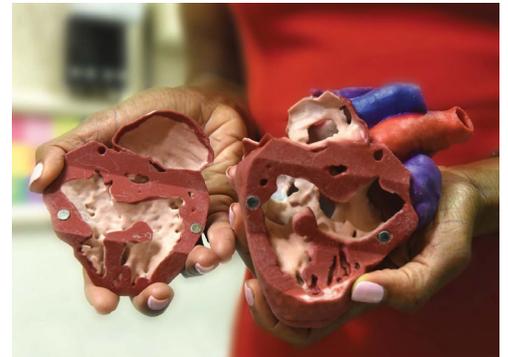
## VENTURES WET LAB



A 650 sq. ft. wet laboratory features molecular and cell biology capabilities as well as specialized equipment for technology validation and testing. Located in the UM BioPark, the lab was opened in FY2020 and is staffed by UMB's Office of Technology Transfer (OTT). In FY2022, two commercial entities based on UMB IP actively utilized the lab.

## MEDICAL DEVICE DEVELOPMENT LAB

UMB's Office of Technology Transfer (OTT) team works with leading UMB surgeons to expand the development of novel medical devices and grow UMB's medical device portfolio. Collaboration with the UMSOM supported development of a medical device innovation and rapid prototyping lab. The space is located within the UMSOM to facilitate easy access for surgeons working in the hospital. UMB's OTT team and the Fischell Institute provide direct support enabling CAD drawings, 3D printing, rapid prototyping, and streamlined patent filing.



Since the lab's creation:

- Eleven device projects have been created by UMSOM faculty.
- Three startups have been formed around projects: Lionheart, Protaryx, and Econnect-1.

FY2022 activities included:

- A medical device design challenge was launched to foster the disclosure of additional potential device development projects.
- Approval was granted to hire a new full time staff person to augment medical device development (expected to hire in early FY2023).

## LIFETIME ACCOMPLISHMENTS

**11** PROJECTS  
CONDUCTED

**5** PATENT APPLICATIONS  
FILED

**3** STARTUPS CREATED

## **MEDICAL DEVICE DEVELOPMENT FUND**

The Medical Device Development Fund launched in October 2018 with the purpose of advancing medical device technologies toward commercialization. Building upon existing resources, such as the Robert E. Fischell Institute for Biomedical Devices, the Fund leverages UMB and UMCP's strengths in medical device development to rapidly contribute to human health related innovation and commercial products.

Thus far there have been 14 awards at \$50,000 each with three projects funded in FY2022 supporting joint research. Projects included:

- Porous gels that can rapidly absorb blood utilizing advanced materials for hemostatic applications. Funds will provide additional data to prove efficacy. Commercialization plans are to license the technology to an existing UMB startup company.
- Thermally responsive alkane partitions for point-of-care diagnostics which allow for sophisticated assays to be performed outside of a central lab and in a timely manner. Funds will be utilized to develop a fully-functional and automated prototype that will further discussions with interested investors and licensees.
- A knee osteoarthritis insole that would provide biofeedback to clinicians to assess the risk of knee osteoarthritis in a patient. Funds will be used to collect clinical data. The technology is planned to be the basis of a new startup company.

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## **CDHX @UMB DIGITAL HEALTH PRE-ACCELERATOR**

UMB collaborated with the Chesapeake Digital Health Exchange to develop and deliver a digital health pre-accelerator to 18 UMB faculty and staff as part of a regional EDA grant. Over six sessions, the program covered topics critical to the successful commercialization of digital health technologies, products, and services. Each session included tailored lectures and rich panel discussions. Lectures were delivered by well-respected experts in medical device commercialization. Additional experienced entrepreneurs and innovators shared their insights and experiences during panel discussions. The program was well-received by all participants and is helping expand digital health technology commercialization at UMB.

## LIFE SCIENCES IP FUND

The Life Sciences IP Fund, created in February 2018, provides proof-of-concept and external validation funding to accelerate commercialization of technologies at UMB. Supported projects receive project management support along with funding for technology validation and further development. Five projects have resulted in the creation of new UMB startups: Isoprene Pharmaceuticals, Protaryx, GEn1E Lifesciences, E-connect, and RenuBioMed. Protaryx and GEn1E have successfully closed initial financing rounds, and in mid-2021, Isoprene received a \$2 million SBIR Direct-to-Phase II grant from the National Cancer Institute. Life Science IP Fund investments have led to an additional \$15 million in catalyzed (third-party) capital, a 15:1 return on investment.

### LIFETIME ACCOMPLISHMENTS

**15:1** ROI

**5** STARTUPS  
FORMED

**26** EARLY-STAGE  
TECHNOLOGIES ASSISTED

## INSTITUTE FOR CLINICAL & TRANSLATIONAL RESEARCH

Institute for Clinical & Translational Research (ICTR), UMB's first Universitywide interdisciplinary hub for clinical translational research and training, operates as part of a consortium with JHU. UMB's OTT team works closely with the UMSOM on ICTR and provides a joint program manager to facilitate identifying promising new technologies. In addition to annual funding, in FY2022, CMAV supported patient-oriented research and Phase II clinical trials through ICTR.

A total of 13 projects were funded in FY2022.

### ATIP Program of ICTR

In FY2022, ICTR created the Accelerated Translation Incubator Pilot (ATIP) program to support innovative, translational research projects.

- 23 applications received and 13 funded for a total of \$451,650
- Participation from all seven UMB schools and 23 out of 24 UMSOM departments
- Collaborations across all UMB schools, UMCP, UMBC, and non-USM institutions

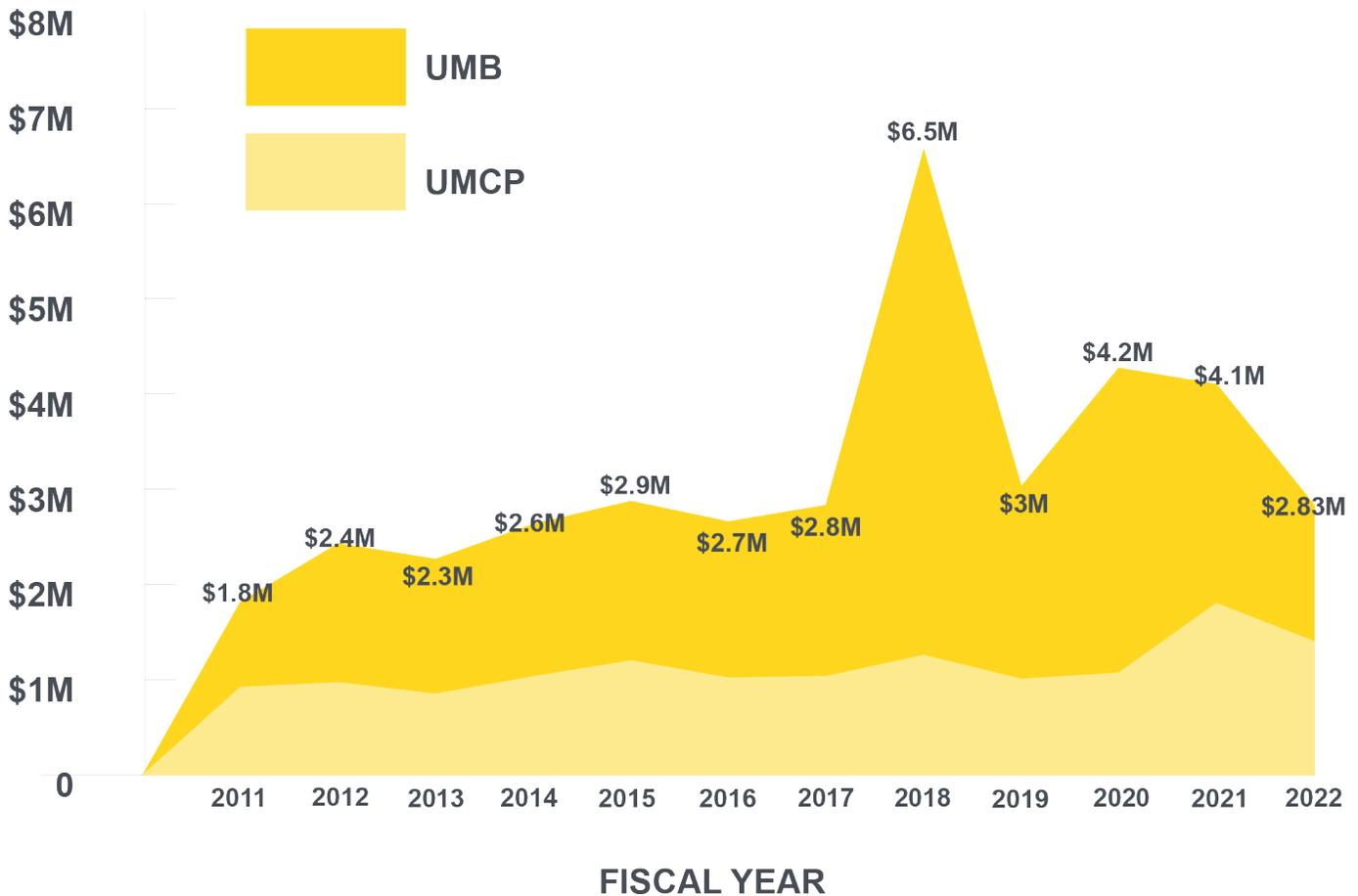
### LIFETIME ACCOMPLISHMENTS

**40%** PROJECTS HAVE RESULTED  
IN IP DISCLOSURES

## VALUE OF LICENSED TECHNOLOGIES

It is difficult and highly speculative to value technologies when they are first licensed; however, technology transfer revenues to UM Ventures have averaged \$4.1 million over the past five years.

### REVENUE RECEIVED



### UMB Investment Portfolio

External investment is a good indicator of the value of our technologies and the strength of our companies. To date, UMB has invested \$1.4 million in the most promising UMB startups, and those companies have received \$86.8 million in follow-on capital investments.

### TOTAL CAPITAL | \$86.8M

CO-FUNDING \$26.3M	FOLLOW-ON CAPITAL \$46.4M	AWARDED GRANTS \$14.1M
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FY2022

**ACCOMPLISHMENTS  
AND  
RECOMMENDATIONS**



## **FY2022 SUMMARY**

1. Expanded programming and outreach to interested USM faculty, staff, and students on technology transfer opportunities and to develop entrepreneurial skills.
  2. Provided direct support to entities affiliated with UMB, UMCP, UMBC, UMES, UMGC, Towson, Coppin and University of Baltimore.
  3. Supported UMCP I-Corps programming at Morgan State, University of Baltimore, and Coppin State, which has brought additional resources to Baltimore City and expanded the entrepreneurial capabilities of these institutions while reaching a more diverse population.
  4. Advocated for and received USM Board of Regents approval to expand the USM allocation for the Maryland Momentum fund by \$6 million.
  5. Based on CMAV's success, obtained an additional \$2.5 million for FY2023 and received BOR approval to expand the Baltimore Fund to make equity investments.
  6. Negotiated 38 licensing amendments (3x more than typical) to support delayed milestones, reduced payments, and revised business plans as a consequence of COVID impacts.
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## **RECOMMENDATIONS FOR FY2023**

1. Strengthen connections with local angel networks and national venture capital companies
2. Continue to expand outreach to and inclusion of underserved populations in activities
3. Create additional opportunities and programs to educate interested USM faculty, staff, and students on technology transfer commercialization and entrepreneurial skills.
4. Enhance support of USM affiliated early stage companies.
5. Create more collaborative programming with other USM institutions and pursue additional external funding opportunities.
6. Work closely with School of Medicine leadership to develop cohesive support programs to increase new faculty startups.
7. Develop additional technology accelerator programs to support new startups in areas including drug development, software, antibodies, and more.
8. Plan and develop programming for CMAV-supported space in 4MLK, the BioPark's new development project.

**UNIVERSITY OF  
MARYLAND  
CENTER FOR  
ECONOMIC AND  
ENTREPRENEURSHIP  
DEVELOPMENT  
FY2022 REPORT**



## **FY22 report on University of Maryland Center for Economic and Entrepreneurship Development (UMCEED) progress at University of Maryland, College Park (UMD)**

*UMCEED shall advance the education of students by developing degree and credential programs in the following fields of study:*

- a. Virtual and augmented reality*
- b. Neurosciences*
- c. Biomedical devices*
- d. Data analytics*
- e. Cybersecurity*
- f. Quantum Technologies, Advanced Data Computing, and Information Technologies  
(added via SB943 in spring 2021)*

### **Introduction**

In higher education, it takes several years to launch new or expand existing academic programs. In addition to developing the curriculum and obtaining the required approvals, instructors must be hired, laboratories and classrooms must be equipped, and students must be recruited to the new programs and make progress to degree. It is also important to note that academic programs are very distinct from entrepreneurship and economic development activities related to IP and startup companies. In FY22, UMCEED funds have been used to support economic development through faculty recruitment, degree programs, and other infrastructure to further the campus mission of economic development in the sectors identified in the bill. Significant progress has been made in recent years toward our UMCEED goals, and we are pleased to provide this FY22 report.

### **Progress on degree production in current UMCEED-related programs and certificates**

- **Immersive Media Design Major**

In Fall 2021 the University launched the new major in Immersive Media Design, through a collaboration between the Colleges of Arts and Humanities (ARHU) and Computer, Mathematical and Natural Sciences (CMNS). This major represents a substantive collaboration between STEM fields and the Arts, and will prepare students to be leaders in the production of Augmented Reality, Virtual Reality, and related Immersive Media Design disciplines. Students will collaborate over the course of several semesters to jointly study and address some of today's most pressing questions about the role of technology as a creative medium. With a fall 2021 launch for new freshmen, first degrees from this program are expected in May 2024, assuming that some students would be able to transfer into the program from other disciplines.

- **iSchool programs**

There has been an extraordinary amount of growth in the iSchool over the past few years, spurred by the tremendous success of new undergraduate majors and specializations. The iSchool continues to grow its programs and graduates, with additional faculty hires using UMCEED funding. The undergraduate major in Information Science, launched in 2016, now has nearly 1200 majors (as of Fall 2021) on the College Park campus as well as a very successful transfer program at the Universities at Shady Grove, with 86 additional majors. In FY22 there were over 450 bachelor's degree recipients, and 165 recipients of master's degrees, and about 25% of the master's degrees were in Human Computer Interaction.

With prior funding from Governor Hogan's Workforce Development Initiative (WDI), the iSchool also launched a new specialization in Cybersecurity, and two academic minors in Information Risk Management and Privacy and in Technology Innovation Leadership. While these will not produce new degree recipients, they will broaden the expertise of students majoring in this area. The iSchool has also recently added a new joint bachelor's/master's option between its BS in Information Sciences and the Master of Information Management.

- **Computer and Data Science**

With the implementation of a limited enrollment program in computer science, the number of majors has stabilized at an enrollment of nearly 3300 students, but the number of degrees granted continues to increase, up 40% in 2022 relative to 2019, with nearly 950 bachelor's degrees in FY22. UMCEED funds have been allocated towards additional faculty to support the very large enrollments. In FY22, a minor in Data Science was added through a collaboration between the departments of Mathematics and Computer Science. A Data Science major has been designed but not yet moved forward for approval, pending identification of resources. Additionally, the CS major was modified to include a Quantum Information track, to complement the existing specialty areas of Data Science, Machine Learning, Cybersecurity and CS education. Also notable is that the number of master's degrees conferred has increased by 60% since 2019, with 98 graduates in FY22.

- **Neuroscience**

Our newly established undergraduate major in Neuroscience successfully launched in Fall 2020, despite the emergency conditions of the pandemic, to help address a critical need to recruit and train talented students at UMD. The Neuroscience major offers rigorous training in the interdisciplinary study of brain and behavior, preparing students for a broad range of career paths, including scientific research, medicine, clinical psychology, allied health professions, and science-related government, nonprofit, and private sector employment. In the Fall of 2020, there were 97 majors, of which 51 were direct admit new freshmen. As of Fall 2022, there are 299 current majors and 35 alumni.

The major is now projected to grow over the next three-year period to a steady state of approximately 500-plus students. The new neuroscience major will continue to encourage more

academically talented Maryland residents to stay in-state for undergraduate training at their flagship institution, thereby increasing the probability that they will contribute to the local scientific, medical, and allied health professions workforce later, rather than going out-of-state for college and graduate training.

### **New academic programs and certificates**

Three new undergraduate degree programs, one master's program and three new certificate programs have been approved in FY22, related to the strategic areas of UMCEED.

- **Bachelor of Arts in Technology and Information Design**

As noted in last year's report, the iSchool has also developed a new Bachelor of Arts in Technology and Information Design, scheduled to launch in Fall 2022. This program will broaden opportunities for those students who are less interested in the technical aspects of information science but more interested in meeting the needs of humans as information consumers. Enrollments are anticipated to be more modest than the Information Science major, with about 50 students per year.

- **Bachelor of Science in Social Data Science**

This newly created major combines the technical requirements of data science with disciplinary areas within the social sciences. The major will build expertise in the complex skills needed to create and work with information that captures aspects of human behavior. Social data science encompasses all elements of the data life cycle, including measure conceptualization, data gathering, management, manipulation, analysis, presentation, archiving, and re-use.

New master's and certificate programs that have been approved and will be launched in the next fiscal year include:

- Master of Professional Studies in Bioinformatics and Computational Biology – Fall 2023 program start
- Post-Baccalaureate Certificate in Remote Sensing (embedded within a very successful program in Geospatial Information Systems)
- Post-Baccalaureate Certificate of Professional Studies in Quantum Computing – Spring 2023
- Post-Baccalaureate Certificate of Professional Studies in Applied Epidemiology – Spring 2023

## Research, Patents, IP, and Economic Development related to the UMCEED sectors

### Inventive, patenting, and licensing activity for FY22 is listed below

While it is very unlikely to be able to make a direct correlation to an academic degree program and patents and licensing by faculty and students, the table below identifies new invention disclosures, patent applications, patents issued, and agreements executed across the six UMEED areas of focus.

Area	Invention Disclosures	Patent applications filed	Patents issued	Agreements Executed
VR/AR	3	1	0	0
Neuroscience	0	0	0	0
Biomedical Devices	25	40	9	2
Data Analytics	26	25	6	1
Cybersecurity	5	2	0	
Quantum	24	37	9	0

- **Brain and Behavior/Neuroscience Initiative**

The Brain and Behavior Institute (BBI) was launched in January 2021, with Dr. Elizabeth Quinlan appointed as the Founding Director. The institute is the foundation for elevation and expansion of neuroscience research efforts across our campus and with UMB. The focus of the BBI is to solve challenges in global health and wellness related to nervous system function in development, aging and disease, and is establishing the University of Maryland and the State of Maryland as a nexus for excellence in research and education in the field of neuroscience. Dr. Quinlan and the BBI are advancing Maryland neuroscience through the recruitment of a cohort of world-class scientists, the development of cutting-edge tools, the facilitation of collaborations with diverse partner disciplines, and the promotion of the translation of basic science.

Since 2016, UMD has invested in the Brain and Behavior Institute (née Initiative), including \$2.7M in the form of seed grants that have been successfully translated into \$22M in new research funding. Resources to support the institute are drawn from UMCEED, The Clark Family Foundation gift, E-Novate funds and contributions from the Provost, Vice President for Research, and the Deans of participating colleges. The first BBI faculty hire opened his research lab in August 2021, and three additional faculty have signed contracts and will open their research labs at UMCP by August 2023. The BBI has also facilitated recruitment of

affiliate faculty in computer science and philosophy to College Park. Dr. Quinlan and the BBI have procured and staffed new state-of-the-art equipment cores to expand campus research in molecular and behavioral science. The BBI-Advanced Genomic Technologies Core, which opened in April 2021, offers the latest approaches to molecular biology and bioinformatics. Imaging began in the BBI-small animal MR imaging facility, following a successful international search for a nuclear physicist to direct the core. In January 2023, the BBI will open a third core, a Cyro-FIB SEM facility, which will expand focused ion beam scanning electron microscopy capabilities to allow for 3D reconstruction of biological ultrastructure, including the nervous system, for the first time.

The BBI also made a major contribution to the upgrade to the campus MR facility, which facilitated the success of BBI investigators in garnering research grants from the NIH HEALTHY Brain and Child Development (\$7.5M over five years) and the NSF Learning the Rules of Neuronal Learning (\$3M over five years). The BBI has established a grants development office, and is actively promoting the formation of multi-disciplinary research teams to compete for large extramural awards. Strategic partnerships forged by the BBI also continue to promote the expansion of basic science. UMCP is now a participant in the UMB Institute for Clinical and Translational Research (ICTR) with Dr. Quinlan as UMCP director and funding from MPower secured in June 2021, UMCP faculty, postdocs, and graduate students are now able to compete for multiple awards through the UMB CTSA. Funding cycles for three award programs are presently underway.

Faculty in the BBI participate in the long-standing and highly regarded graduate program in Neuroscience and Cognitive Science (NACS), providing training for graduate students from around the world. Dr. Quinlan has secured UMCEED funding for cross-campus training by neuroscience graduate students to promote enhanced collaboration between research groups in Baltimore and College Park. The program provides funding for research rotations of UMB Program in Neuroscience students in College Park and UMCP NACS students in Baltimore. Two cohorts of UMCEED-funded Visiting Graduate Fellows in Neuroscience Program award recipients have participated in research training, with the third call for applications to be released in Spring 2023. Students in this program diversify their training experience through exposure to new topics and procedures in an alternative research environment like a medical school.

Strengthening the brain and behavior community will continue the success of UMCP and UMB in recruiting talented faculty to perform cutting-edge, interdisciplinary research. Synergy with the emerging MPower initiatives focused on neurobiology, aging and global health will afford support and collaboration opportunities for existing and new faculty in brain research, amplifying clinical trial capabilities at UMD while elevating and extending our competitiveness to acquire external funding from leading federal agencies.

- **Quantum Technology - Establishing the Capital of Quantum**

Building on UMD's decades of global leadership in advancing quantum information science and technology, UMD is now leading regional efforts to build an inclusive quantum innovation ecosystem. The Institute for Robust Quantum Simulation, one of just five NSF Quantum Leap Challenge Institutes, became operational in 2022 as UMD's latest major quantum research center. UMD has also invested \$20 million to accelerate practical quantum computing and networking through the unique National Quantum Laboratory (Q-Lab) partnership with IonQ, a UMD spin-off that became the first publicly traded pure-play quantum computing company in 2021. Q-Lab's physical colocation space will open in Fall 2022, but it is already supporting research projects in high-energy physics, materials science, image processing, cybersecurity and computational fluid dynamics.

UMD is preparing the workforce through a wide range of quantum education efforts at all levels. These include a new quantum information specialization in computer science, training for local K-12 teachers to integrate quantum education into their classrooms, summer programs for high school and middle school girls and underrepresented minority students, an international bootcamp to build a community of quantum computing and earth science researchers and graduate students, quantum hackathons, and launching the Quantum Machine Learning stream in the First-Year Innovation & Research Experience (FIRE) program. As noted above, a new post-baccalaureate certificate in Quantum Computing was approved in spring 2022. To support these new educational efforts, UMD has allocated \$1M in UMCEED funding towards new tenure track faculty hires in Computer Science and in Engineering.

UMD also leads the Mid-Atlantic Quantum Alliance, which enables collaboration between over 30 regional partners from government, industry, academia and non-profits. UMD launched the Quantum Startup Foundry (QSF) to help startups move emerging quantum technologies from the lab to use; QSF has already supported over 20 quantum startup companies since April 2021. For more on UMD's quantum ecosystem, visit [quantum.umd.edu](https://quantum.umd.edu).