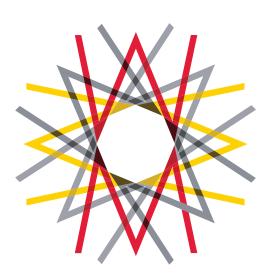
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Position: FAV

CENTER FOR MARYLAND ADVANCED VENTURES FY 2020 REPORT



CENTER FOR MARYLAND ADVANCED VENTURES OVERVIEW

The University of Maryland Strategic Partnership Act of 2016 created and funded the Center for Maryland Advanced Ventures (CMAV), which launched on July 1, 2017. The legislation provides \$4 million annually to strengthen the commercialization of high-potential, university-based discoveries. Located in Baltimore City on the University of Maryland, Baltimore campus, CMAV is led by Jim Hughes, Director of CMAV and UMB's Senior Vice President and Chief Enterprise and Economic Development



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President and Chief Enterprise and Economic Development James L. Hughes, MBA Officer.

CMAV has implemented a series of strategic and thoughtful initiatives to fulfill its legislative mission of facilitating technology transfer, identifying research projects that can be commercialized, and developing programs to support that commercialization. The initiatives connect to and expand existing UM Ventures programming, enhancing support for the advancement of technology commercialization. Through collaboration with TEDCO and the Maryland Department of Commerce, CMAV is able to leverage existing Maryland programs, ensuring they are fully integrated with and complimentary to CMAV initiatives. CMAV works with these entities to continually augment offerings to address emerging technologies. In FY2020, additional programs were created in response to COVID-19.

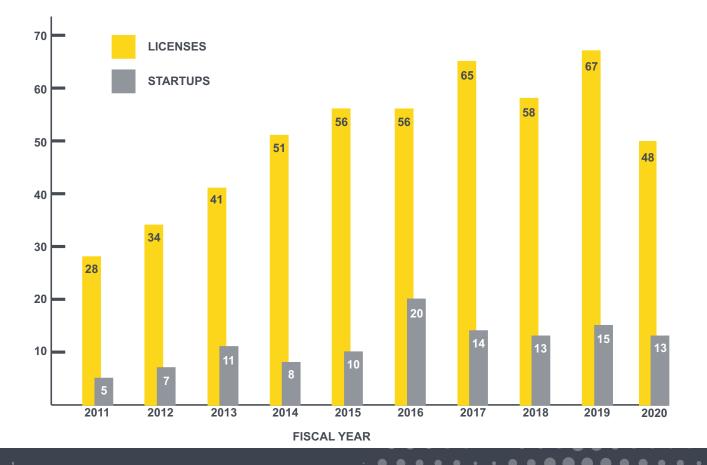
TECHNOLOGY COMMERCIALIZATION



Since UM Ventures was formed in 2012, there has been a dramatic increase in technology transfer activities at both UMB and UMCP. In FY2020, UM Ventures recorded 333 new disclosures, 48 licenses, created 13 new start-ups, and was awarded 17 Maryland Innovation Initiative (MII) grants. Licensing results in FY2020 were depressed due to economic turmoil related to the COVID-19 pandemic, however, start-up creation remained strong and included several enterprises directly related to addressing COVID-19.

Strategic industry partnerships have strengthened and the portfolio of high-profile start-ups has increased. These goals have been achieved through the concerted effort of UM Ventures staff and industry outreach.

In addition, targeted initiatives have been created to support and advance technology transfer and commercialization.

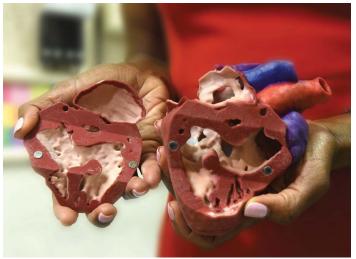


SPECIALIZED FACILITIES

Specialized facilities have been created at UMB to further foster technology commercialization.

- A 650 sq. ft. wet laboratory with molecular and cell biology capabilities and specialized equipment was opened in the UM BioPark in FY2020 and is staffed by UMB's Office of Technology Transfer (OTT).
- After significant work with leading UMB surgeons to expand the development of novel medical devices, a medical device innovation and

rapid prototyping space was created in collaboration with the University of Maryland School of Medicine (UMSOM). Located in the UMSOM and connected to the University of Maryland Medical Center, the space facilitates easy access for surgeons. OTT and the Robert E. Fischell Institute for Biomedical Devices will provide direct support, enabling CAD drawings, 3D printing, rapid



prototyping, and streamlined patent filing, all of which will support the rapid expansion of UMB's medical device portfolio. This effort is financially supported by significant philanthropic contributions to UMSOM.

LIFE SCIENCES IP FUND

21 TECHNOLOGIES

UMB START-UPS FORMED

The Life Sciences IP Fund provides proof-of-concept and external validation funding to accelerate commercialization of technologies at UMB. Since the program's inception in February 2018, **CMAV has assisted 21 early-stage technologies, including 10 device and 11 therapeutic technologies, in moving towards commercialization.** All have received project management support along with funding for technology validation and further development. Three new UMB start-ups, Isoprene Pharmaceuticals, Protaryx, and GEn1E Lifesciences, have been formed as a result of the program. Both Protaryx and GEn1E Lifesciences have successfully completed initial financing rounds, and Isoprene recently executed a sublicense agreement with Hoth Therapeutics.

INSTITUTE FOR CLINICAL & TRANSLATIONAL RESEARCH

17 PROJECTS FUNDED

1 COVID-19 PROJECTS

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UMB's Institute for Clinical & Translational Research (ICTR) is the first Universitywide interdisciplinary hub for clinical translational research and training. CMAV funds supported this unique center which operates as part of a consortium with JHU. **ICTR funded 17 general projects and 10 COVID-19specific projects in FY2020. Of these, it is anticipated that 21 have potential technology transfer value.** UMB's Office of Technology Transfer works closely with UMSOM on this initiative and aa joint program manager facilitates interaction. CMAV also supported patient-oriented research and Phase II clinical trials through ICTR.

ARTIFICIAL INTELLIGENCE & MEDICINE FOR HIGH IMPACT CHALLENGE AWARD

The Artificial Intelligence & Medicine for High Impact Challenge Award (AIM-HI) was launched by UMB and UMCP to support innovation in the fields of artificial intelligence and medicine. Four joint UMB/UMCP research teams were selected for funding.

MEDICAL DEVICE DEVELOPMENT FUND

\$200K AWARDS FUNDING COVID-19 PROJECTS

The Medical Device Development Fund launched in October 2018 with the purpose of contributing to a meaningful milestone that would advance a medical device technology towards commercialization. In FY2020, the Fund focused on proposals that would contribute to the commercialization of evidencebased medical devices related to the COVID-19 pandemic. The technologies utilize UMB and UMCP strengths in medical devices (e.g., Robert E. Fischell Institute) and related innovation (e.g., computer technology) to rapidly contribute to human health and related outcomes with respect to COVID-19 or the causal virus (SARS-CoV-2), including prevention, control, and response efforts. Awards of \$50,00 each were made to four joint UMB/UMCP projects.

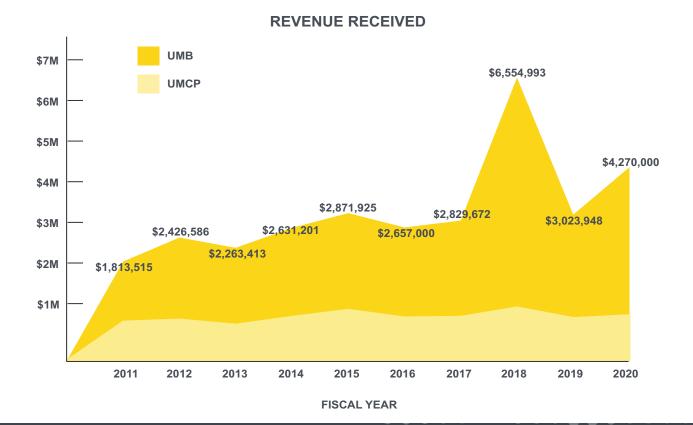
ONEX

OnEx, UM Ventures' online express license store which offers a streamlined licensing experience for select software and materials, processed 39 transactions in FY2020. The store creates an additional access point for industry to peruse technologies that are routine and ready to be commercialized. Plans are underway to streamline the payment system to support an increase in the number of transactions.

VALUE OF LICENSED TECHNOLOGIES

It is difficult and highly speculative to value technologies when they are first licensed, however, the technology transfer revenues to UM Ventures increased in FY2020 to \$4.25 million. UM Ventures has also seen four acquisitions of UMB technologies in three years.

Additionally, equity raised by UM Ventures start-up companies is a good indicator of the value of the technology and the strength of the management team. **Publicly disclosed equity raised by our start-ups exceeded \$12 million in FY2020. Two UMB start-ups, SurgiGyn and Breethe, were sold in FY2020** with undisclosed terms. SurgiGyn also recently announced a Series B investment of \$7 million.



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MARYLAND MOMENTUM FUND

8 INVESTMENTS \$1.8M INVESTED

A collaboration between UM Ventures and the University System of Maryland (USM), the Maryland Momentum Fund (MMF) is a \$10 million early-stage investment fund that invests in Maryland-based, USM-affiliated start-up companies. With input from 28 review panels, the external advisory board reviewed 21 companies for investment in FY2020, approving eight. A total of \$1.8 million was invested by MMF and other USM institutions. To date, MMF has invested a total of \$4.6875 million in 16 companies (including several follow-on rounds), representing eight USM campuses. MMF's investment has been matched by \$21 million from more than 20 co-investors. This 5:1 match of USM dollars far surpasses the original goal of a 2:1 match. Portfolio companies have created 66 new jobs and increased their valuation substantially.

CMAV funds a full-time Director based at UMB, partially funds additional staff based at UMCP, and covers operational expenses for the program. MMF staff work with all 12 USM institutions to solicit applications for funding and provide advice and support to entrepreneurs across USM campuses.

PRESIDENT'S ENTREPRENEURIAL FELLOWSHIP

The President's Entrepreneurial Fellowship program provides UMB and University of Maryland, College Park 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, commercializing UMB-owned technologies. Seven students from four UMB schools were accepted into the 2019-20 cohort. The Fellows again worked with Isoprene Pharmaceutical, this year focusing on preparing for pre-clinical animal safety studies of toxicity and metabolism and an SBIR submission. Plans were created to move the President's Entrepreneurial Fellows program to an online platform for the 2020-21 cohort.

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GRADUATE RESEARCH INNOVATION DISTRICT

The Graduate Research Innovation District (Grid), created in 2017, fosters student entrepreneurship through a variety of educational opportunities, entrepreneurial resources, and programming. Co-located with startups in the UM BioPark's Lion Brothers Building's innovation space, the Grid gives students a peek into the day-today life of an entrepreneur building their company. The Lion Brothers Building, along with CMAV, provides early-stage



companies with the space and services needed to grow their ventures.

START-UP TENANTS

UM BioPark tenants in the Lion Brothers Building include a number of startup companies, such as b.well and ARMR, the Grid, UMB Graduate School, the Small Business Development Center, and the Carey School of Law IP and Business Law Clinic.

During FY2020, two Lion Brothers start-up companies achieved significant growth. CMAV supported seven additional early-stage companies in making the Lion Brothers Building's innovation space their headquarters.

bwell

b.well, a health IT firm founded in 2015 with five employees, grew to more than 50 employees nationally and graduated from the Lion Brothers space at the end of the fiscal year.

ARMR

ARMR, a medical device company engineering a next-generation tourniquet, tripled their leasing space, expanding into a new suite of offices within the Lion Brothers Building, raised a \$750,000 seed round which included a \$350,000 joint investment from UMB and MMF, established a strategic relationship with the R Adams Cowley Shock Trauma Center, and hired additional employees.

STUDENT PROGRAMS

The Grid's opportunities for student entrepreneurs and innovators expanded with nearly 900 participants in more than 20 programs. Additionally, eight teams participated in the Grid Pitch, an annual showcase where students pitch their innovative business ideas to a panel of experts and investors. Final presentations were held virtually due to COVID-19 restrictions.



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In September 2019, the Grid became home to the UMB Graduate School's MS in Health and Social Innovation. Six students formed the inaugural cohort.

At the end of FY2020, the Grid relocated from the UM BioPark to the main UMB campus. The new location in the Health Sciences and Human Services Library (HS/HSL) provides a more central convening destination for students, faculty, staff, and the community. The innovation space in the UM BioPark's Lion Brothers Building continues to house early-stage companies.

SMALL BUSINESS DEVELOPMENT CENTER

The Small Business Development Center (SBDC), the Federal small business outreach entity, is supported by CMAV with funding and space. With two locations, one on the main UMB campus and one in the UM BioPark's Lion Brothers Building's innovation space, the SBDC is strategically positioned to provide direct assistance to local and University-affiliated entrepreneurs. During FY2020, they served 358 new clients in Baltimore City, resulting in the creation of 108 jobs and 21 new businesses. They also provided over \$18 million in 81 SBA loans and an additional 39 COVID-19 funding actions.

INTELLECTUAL PROPERTY LAW AND ENTREPRENEURSHIP CLINIC

The Intellectual Property Law and Entrepreneurship Clinic (IPEC), supervised by Patricia Campbell, law school professor, and two part-time clinical law instructors, engaged 24 second- and third-year law students (12 each semester). The students gained valuable work experience providing 117 clients with general counselling on basic business law, the protection of trade secrets, and preparing nondisclosure agreements. They also assisted with the formation of four new Maryland limited liability companies and worked with clients to file five copyright registrations, 50 trademark applications, and 19 patent applications. Service was suspended on March 5, 2020 due to COVID-19 restrictions, but will resume once the University returns to standard operations.

GRANT ACTIVITIES

ANCHOR VENTURES

Anchor Ventures harnesses the collective expertise and influence of local universities, key stakeholders, entrepreneurs, and investors to foster the collaboration and education of Baltimore's innovation ecosystem. Led by a cohesive team of entrepreneurial staff from UMB, Johns Hopkins University (JHU), the USM Chancellor's Office, and University of Maryland, Baltimore County (UMBC), Anchor Ventures provided six programmed events during FY2020. When COVID-19 shuttered in-person

events, the Anchor Ventures team transitioned to a

ANCHOR

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virtual series, collaborating with the Chesapeake Digital Health Exchange (CDHx) to provide a four-part digital health series in May 2020. Over the course of the series, there were more than 365 live attendees and thousands of post-event views of the content. Anchor Ventures received a grant from the Maryland Department of Commerce to support programming in FY2021.

MARYLAND DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT SEED GRANT

A SEED Grant from the Maryland Department of Housing and Community Development (DHCD), is supporting UMB's development of additional entrepreneurial infrastructure in West Baltimore. The **\$750,000 grant provides funding to off-set the development of District Hall**, an 11,400 sq. ft. innovaton space in the 4MLK, UM BioPark's planned 330,000 sq. ft. mixed-use building. District Hall will provide places where companies of all sizes, stages, and industries can build their businesses and connect with one another as well as regional anchor institutions. Wexford Science + Technology, the developer of 4MLK, is matching the award. UMB is leveraging its innovation expertise by teaming with DHCD to help revitalize the historic Packing House in Cambridge, Maryland.

BALTIMORE FUND

18 COMPANIES



The Baltimore Fund encourages University-created or -sponsored technology companies to locate and expand in Baltimore City as specified in the legislation. The program is open to all Maryland public higher education institutions and is administered by UMB. Through 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 helps facilitate the growth of companies.

- Since its inception in 2017, UMB has provided conditional grants to 18 companies. To date, these companies have created and/or retained over 400 jobs in Baltimore City.
- Of these grants, 12 emerging companies received lease subsidies to establish operations in Baltimore City, and six grants supported the direct expansion of existing companies.
- The Baltimore Fund collaborates with six Baltimore City locations and USM institutions located in Baltimore to source and house the emerging companies.
- Companies receiving Baltimore Fund conditional grants represent four USM institutions and a wide array of technologies.

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FY2020 METRICS SUMMARY

- 1. Technology transfer transaction efforts at UMB and UMCP have been augmented with CMAV initiatives, resulting in 333 disclosures, 48 licenses ,and 13 new start-up companies in FY2020.
- 2. UM Ventures staff created new programs and services to increase the pipeline of technologies that will likely convert to technology transfer opportunities in future years.
- 3. CMAV initiated extensive outreach to University entrepreneurs and industry partners, and developed multiple strategic initiatives to deliver funding, educational, and programmatic support.
- 4. UM Ventures received revenue in excess of \$4 million in FY2020 from technology transfer activities.
- 5. Publicly disclosed equity raised by UMB start-ups exceeded \$12 million in FY2020; non-disclosed equity was significantly higher.
- 6. Direct support was provided to entities affiliated with UMB, UMCP, UMBC, University of Maryland, Eastern Shore, University of Maryland Global Campus, Towson University, and University of Baltimore in FY2020.
- 7. New programs were created to encourage IP creation and development in response to the COVID-19 pandemic.

RECOMMENDATION FOR FY2021

- Support connections between tech transfer activities and research parks/ incubators.
- Strengthen connections with local angel networks and national venture capital companies.

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- Ensure outreach to and inclusion of underserved populations in activities.
- Create more opportunities to educate interested USM faculty, staff, and students on technology transfer opportunities and entrepreneurial skills.

SB943 University of Maryland Strategic Partnership Uploaded by: Jarrell, President Bruce

Position: FAV





SB943 - University of Maryland Strategic Partnership Act of 2016 -Appropriations and Degree and Credential Programs - Alterations Favorable March 9, 2021 Senate Budget and Taxation Committee

The University of Maryland Strategic Partnership: MPowering the State (MPower) combines the extraordinary resources of the state's largest public research engines — the University of Maryland, Baltimore (UMB) and the University of Maryland, College Park (UMCP) — to strengthen and serve the State of Maryland and its citizens. MPower has fostered hundreds of collaborations that are growing Maryland's innovation economy, advancing interdisciplinary research, increasing educational benefits, and addressing the state's most critical issues.

The MPowering the State (MPower) partnership was originally launched in 2012 and further advanced by the University of Maryland Strategic Partnership Act passed by the Maryland General Assembly in 2016. The partnership was further formalized in 2018 with the appointment of one vice president for research to lead the joint research enterprise.

For the first time, the University of Maryland, College Park and the University of Maryland, Baltimore were linked together in 2020 as one research enterprise in the ranking, with combined research expenditures of \$1.1 billion. This expanded research effort earned us a ranking of No. 14 overall and No. 8 among public institutions. With this new ranking, the state of Maryland joins an elite group of six states with more than one research university conducting research at or above \$1 billion per year. SB943 will allow us to build upon this unprecedented success and help us to drive the future of Maryland.

The Strategic Partnership Act created and funded the Center for Maryland Advanced Ventures (CMAV), launched in FY 2018, with \$4 million in annual funding to strengthen the commercialization of high-potential, university-based discoveries. CMAV has fulfilled its legislative mission of facilitating technology transfer, identifying research projects that can be commercialized, and developing programs to support that commercialization. The USM Maryland Momentum Fund, which is staffed by CMAV, has invested nearly \$7 million in 25 companies affiliated with 7 University System of Maryland institutions. The USM investment has been matched by \$36 million from 120 private investors.

With additional funding provided in SB943, CMAV will be able to significantly increase entrepreneurship and job creation in Maryland, creating and/or retaining approximately 100 jobs per year in Baltimore City. We will particularly focus on increasing diversity of management-level positions in University created and sponsored businesses and creating lab incubator space for University start-ups. Funds will also be invested in high priority translational research, including Artificial Intelligence, Health Informatics, and Personalized Medicine. These focus areas capitalize on strengths at UMB and UMCP, expanding research and commercialization collaborations between both universities.

Another initiative of the Strategic Partnership is the Baltimore Fund, which has created and/or retained 400 jobs in Baltimore City through conditional grants to 18 companies affiliated with Maryland public higher education institutions. One major example is Paragon Bioservices, which after receiving a grant from the Baltimore Fund, was acquired by Catalent for \$1.2 billion and has expanded to over 1,000 jobs in Maryland, with major facilities in Baltimore City, Anne Arundel County, Montgomery County, and the UMBC Research & Technology Park in Baltimore County.

Similar to the Baltimore Fund, SB943 provides funds to allow UMCP to help create the economy of the future in Prince George's County and the State of Maryland by continuing to build an ecosystem of innovation and entrepreneurship. Of the recently announced *Future 20 Companies* the Maryland Department of Commerce listed as having the best change for growth and job creation, seven are in Prince George's County and six are located in the UMCP Discovery District. However, there are also many potential new companies that never get off the ground because they lack early funding. This much needed new investment will support the operations of newly created companies spinning out of UMCP labs and classrooms at the early and vulnerable stage so that more of these companies can grow into meaningful job creation engines for the economy of the State of Maryland.

Established by law in 2016, University of Maryland Center for Economic and Entrepreneurship Development (UMCEED) increases workforce readiness by creating educational degree programs in high-impact fields such as neuroscience, virtual and augmented reality, biomedical devices, data analytics, and cybersecurity. Examples include the Visiting Fellows in Neuroscience Program launched to offer cross-campus training in neuroscience. Graduate students at UMB and UMCP are working with research groups at the opposite campus to acquire new techniques and broaden their training. Through UMCEED we were able to launch a new, undergraduate Neuroscience major at UMCP in fall 2020, to train students interested in health care, allied health careers, biomedical industries, and clinical psychology.

The bill will strengthen the success of UMCEED by adding Quantum, Advanced Data Computing and Information Technologies to the mandate of fields of study that UMCEED can engage in. With this change we will be able to build on our successes in these vitally important areas. The state of Maryland is poised to be a leader in many emerging high technology fields and SB943 broadens our efforts to be a world leader in creating the economy of the future.

UMB and UMCP urge a favorable report on SB943.

SB943 Written Testimony UMCP UMB.pdf Uploaded by: Pines, Darryl

Position: FAV





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UM_MPower_Booklet-2021-V8-ADA.pdf Uploaded by: Pines, Darryl

Position: FAV



UNIVERSITY OF MARYLAND STRATEGIC PARTNERSHIP MPOWERING THE STATE



Del. Keith Haynes (Baltimore City) experiences firsthand the innovative research from the strategic partnership at MPower Day in Annapolis in January 2020.

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COLLABORATION. INNOVATION. IMPACT.

The University of Maryland Strategic Partnership: *MPowering the State (MPower)* combines the extraordinary resources of the state's largest public research engines — the University of Maryland, Baltimore (UMB) and the University of Maryland, College Park (UMCP) — to strengthen and serve the state of Maryland and its citizens.

Since its creation in 2012, *MPower* has fostered **hundreds** of collaborations that are growing Maryland's innovation economy, advancing interdisciplinary research, increasing educational benefits, and addressing the state's most critical issues.









To learn more about our impact, and our future, please visit *mpower.maryland.edu*.

ADVANCING RESEARCH AND ADDRESSING REAL-WORLD PROBLEMS

The University of Maryland Strategic Partnership: *MPowering the State* creates and supports complementary, multidisciplinary research collaborations that ignite innovation and high-impact discoveries. UMB and UMCP cultivate scores of partnerships with governments and businesses, creating jobs and underscoring Maryland's distinction as a top research innovator in the nation.

Every day, researchers at UMB and UMCP address the most challenging issues of the 21st century and impact global change. Now, national recognition of these achievements places the University of Maryland among the top research universities in the United States — both public and private.



MARYLAND: A NATIONALLY RECOGNIZED RESEARCH POWERHOUSE

AMONG ALL PUBLIC U.S. RESEARCH UNIVERSITIES for research and development spending No. 14 IN THE NATION National Science Foundation, Higher Education Research and Development Survey, FY 2019, Released January 2021

Advancing Research and Addressing Real-World Problems



\$1.2 BILLION +

FY 20 UMB AND UMCP COMBINED AWARDS FROM FEDERAL, STATE, AND LOCAL RESEARCH GRANTS AND CONTRACTS





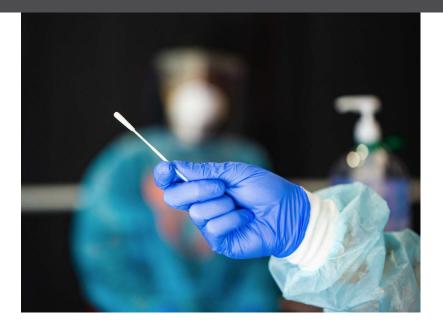
1 VICE PRESIDENT FOR RESEARCH

JOINTLY APPOINTED BY THE UMB AND UMCP PRESIDENTS IN 2018 4

UM STRATEGIC PARTNERSHIP

TAKING AIM AT COVID-19

COVID-19 challenged and changed the way we work, learn, and live. The University of Maryland Strategic Partnership: *MPowering the State* moved quickly to bring together its top thinkers to address this complex medical and human crisis.



\$700,000 FOR PANDEMIC RESEARCH AWARDS MADE TO NINE MULTIDISCIPLINARY RESEARCH TEAMS Mobilizing quickly in spring 2020, *MPower* challenged its world-class researchers to bring solutions that offer immediate action to address the pandemic and prepare for future pandemics.

- In one challenge, 50 teams submitted projects that would capitalize on the vast research expertise across UMB and UMCP and showcase collaboration from multiple schools and colleges. Teams represented strengths in a wide range of disciplines, including medicine, public health, and pharmaceutical sciences, as well as computer, mathematical and natural sciences, and arts and humanities. Five teams received funding of \$500,000, including:
 - Two projects to support vaccine development
 - One to develop a rapid testing method
 - One to study the factors that impact vaccine acceptance among minority communities
 - One to explore the use of an artificial intelligence tool for delivery of child behavioral health services via telemedicine in rural Maryland communities
- A second challenge funds research that contributes to commercialization of evidence-based medical devices that will lead to better detection, prevention, and control of COVID-19 and other pathogens. Four collaborative teams were awarded \$200,000 for research related to testing, personal protection, treatment, and prevention.

SELECTED RESEARCH PARTNERSHIPS

OPIOID USE DISORDERS RESEARCH COLLABORATION: Developing treatments to address the opioid epidemic in Maryland and nationwide.

UMB's School of Medicine, UMCP's Center for Substance Abuse Research, and two dozen other schools and departments are researching solutions to address the opioid epidemic that kills thousands of Marylanders each year. Results from this multiyear work are impacting training, outreach, and policy while sparking new collaborations and grants.

MARYLAND BLENDED REALITY CENTER:

Developing innovative applications for visual computing technology in research, health care, and training.

UMCP computer scientists and UMB medical professionals are researching the use of augmented and virtual reality technology in medical and health care applications such as critical care patient diagnostic tools, nonopioid pain management, and next-generation medical education tools. This immersive technology also is being used to train police to identify and combat implicit bias.



Maryland Blended Reality Center

CENTER FOR BRAIN HEALTH AND HUMAN PERFORMANCE AT COLE FIELD HOUSE:

Cutting-edge center focusing on the advanced study of the brain and nervous system. New research collaborations will explore the neurobiology of aging and age-related neurodegeneration.

The new center at the renovated Cole Field House in College Park — the first shared research facility created by the Strategic Partnership — brings together leading researchers in neuroscience, genomics, biomechanics, and other fields. An adjacent orthopaedic center will bring leading-edge medical facilities to UMCP, allowing for the rapid translation of research into practice.

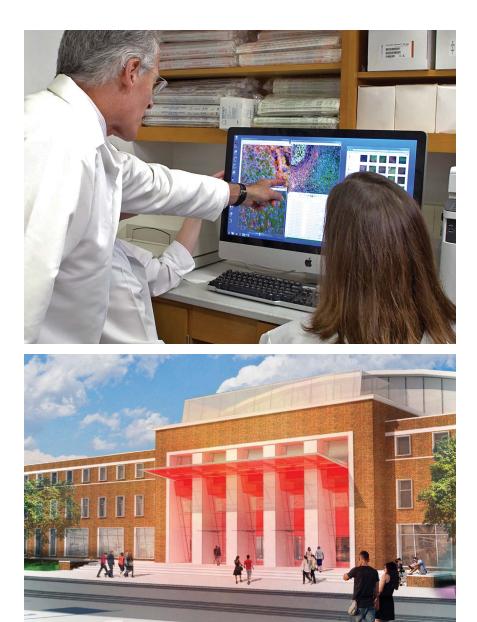
INSTITUTE FOR BIOSCIENCE AND BIOTECHNOLOGY RESEARCH (IBBR):

Developing solutions to address major health and scientific challenges that benefit patients while creating economic development in Maryland.

Located in Montgomery County, in the heart of Maryland's biotechnology corridor, IBBR is a partnership among UMB, UMCP, and the National Institute of Standards and Technology (NIST). It forms key alliances with biopharmaceutical companies and federal agencies to develop biomedical and health care solutions and accelerate commercialization. Among dozens of projects, researchers are developing vaccines for hepatitis C and other infectious agents. IBBR also provides infrastructure support to the biopharmaceutical industry through a nationwide publicprivate partnership.

MARYLAND COCHLEAR IMPLANT CENTER OF EXCELLENCE: Delivering advanced care to people with hearing loss.

Collaborators are combining the research and educational strengths of UMCP in audiology and speech-language pathology with the surgical and clinical expertise from School of Medicine faculty at UMB to deliver cutting-edge care for people with hearing loss. The goal is to make Maryland the premier location for educational training, clinical services, and basic and translational biomedical research on cochlear implants.



Center for Brain Health and Human Performance at Cole Field House

MARYLAND CENTER FOR ADVANCED MOLECULAR ANALYSIS (M-CAMA):

Advancing the research and development of new drugs and medical treatments for disease.

Located within IBBR in Rockville, the new center positions the University of Maryland to become a national leader in the use of cryo-electron microscopy (cryo-EM) technology to drive scientific innovation and discovery. Recognized as a breakthrough tool in developing drugs and medical treatments, cryo-EM impacts biomedical research through its ability to deliver imaging that transforms the understanding of biology and drug interactions in the human body. Working in partnership with NIST, the center houses cutting-edge instruments — as well as scientific leadership that has deep expertise with this technology — to guide and assist users from any University System of Maryland institution, as well as industry partners.

ROBERT E. FISCHELL INSTITUTE FOR BIOMEDICAL DEVICES: *Bringing together skilled scientists, medical doctors, health practitioners, and bioengineers to research, design, and build lifesaving biomedical devices and train the next generation of innovators.*

The institute catalyzes the transformation of basic research into clinical practice and commercial success. The staff and a network of experts facilitate prototyping and manufacturing, as well as venture creation, intellectual property creation, and successful passage of a product through various clinical, regulatory, and reimbursement hurdles. The institute has a UMCP innovation space for students, entrepreneurs, faculty, and staff, and will offer a location at UMB in 2021.



Camp for children with hearing loss | Maryland Cochlear Implant Center of Excellence



Robert E. Fischell Institute for Biomedical Devices

GROWING MARYLAND'S ECONOMY

The University of Maryland Strategic Partnership: *MPowering the State* fuels the state's reputation as an international, intellectual, and commercialization leader by consistently bringing scientific discoveries and inventions to market.

The UM Ventures collaboration combines the entrepreneurial resources at UMB and UMCP to help researchers and inventors license, patent, and commercialize their universityinvented creations, and launch university startups. Faculty-invented products and services include agriculture products, software, clean technology, nanotechnology, sensors, medical devices, diagnostics, and therapeutics. In Fiscal Year 2020, UM Ventures tallied 333 potential inventions from faculty with 48 licensed to companies, generating more than \$4 million in licensing revenue to UMB and UMCP.

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STARTUPS LAUNCHED SINCE 2011

48 INVENTIONS LICENSED TO COMPANIES IN FISCAL YEAR 20

	FY20	Growth FY11 to FY20
Invention Disclosures	333	61%
Licenses	48	71%
Startups	13	160%

400+ JOBS CREATED OR RETAINED IN BALTIMORE

BY THE CENTER FOR MARYLAND ADVANCED VENTURES SINCE 2017 UM Ventures manages the **Center for Maryland Advanced Ventures** (**CMAV**), created by law in 2016 to strengthen the commercialization of high-potential, university-based discoveries, and to create jobs in Baltimore City by encouraging university-created or -sponsored technology companies to locate in the city. **CMAV funds have been committed to 18 university-affiliated or -sponsored technology entities, creating or retaining more than 400 jobs in Baltimore City.** CMAV initiatives also provide mentorship to UMB and UMCP students on the unique challenges of commercialization in the life sciences industry, while offering creative, collaborative support and funding to entrepreneurs. CMAV also staffs the **Maryland Momentum Fund (MMF)**, a USM, \$10 million early-stage investment fund that invests in Marylandbased, USM-affiliated startup companies. CMAV funds a full-time director of MMF, based at UMB, and partially funds additional staff based at UMCP. In Fiscal Year 2020, MMF reviewed 21 companies seeking investments, and it invested in nine companies. *The MMF investment helps companies bridge from early success to the next stage of growth, which is often a large investment, commercial launch, or commercial expansion.*



UM Ventures/Center for Maryland Advanced Ventures

RECENT UM VENTURES SUCCESSES

Airgility, a UMCP startup that employs 20 people in College Park, is developing cutting-edge artificial intelligence and autonomy solutions for unmanned systems in a variety of areas, including COVID-19-fighting robots and medical delivery/logistics to remote parts of the globe. Airgility was selected to be part of a pilot project in an inaugural U.S. Air Force Labs-sponsored program, and it recently closed a \$1 million seed round.

Breethe, a UMB startup developing a portable artificial lung, was acquired by Abiomed in late spring 2020. UM Ventures was an early investor in the company, and Breethe marks the fourth UM Ventures-backed startup to have a successful exit via acquisition. Breethe's headquarters remains in Baltimore City.

Decision Point Analytics, a UMCP cybersecurity risk management startup, partnered with Information Systems Audit and Control Association, a leading professional certification and credentialing body, to extend cybermaturity and risk assessment services to their customer base, leveraging the startup's Tapestry application. **GEn1E Lifesciences**, a UMB startup based in San Francisco, licensed UM Venturesbacked technology to help address acute respiratory distress syndrome and raised \$3 million. Led by Ritu Lal, PhD, MS, a graduate of the University of Maryland School of Pharmacy, GEn1E is working to develop cures for inflammatory and agerelated diseases.

GlycoT Therapeutics, a joint UMB and UMCP startup, sublicensed intellectual property to Daiichi Sankyo. The enzymatic glycoengineering technology provides a platform to precisely change and modify the sugars on antibodies. Daiichi Sankyo plans to use this cuttingedge technology to prepare new drug candidates.

Hazel Analytics, a UMCP-born technology company, is the proven market leader in health department data analytics, serving nearly half of the 100 largest food service and retail brands. Hazel's award-winning products transform diffuse and disparate local health department data into actionable intelligence. Hazel's 200-plus customers - including Amazon, Cheesecake Factory, Starbucks, and Uber Eats — rely on its technology to proactively monitor food safety and regulatory compliance at over 300.000 locations that serve millions of meals every day in the United States and Canada.

IonQ, a UMCP startup and a leader in the quantum computing field, recently unveiled the world's most powerful quantum computer — a next-generation system featuring 32 perfect atomic qubits with low gate errors and an expected guantum volume greater than 4 million. In fall 2020, the company opened a 23.000-square-foot quantum data center in UMCP's Discovery District, which houses the firm's state-of-the-art quantum computers, and will significantly expedite the development of even more powerful quantum computers for commercial use. lonQ has raised \$84 million in funding to date from investors that include Samsung Electronics, Mubadala Capital, GV (formerly Google Ventures), Amazon, Lockheed Martin, and New Enterprise Associates.

Isoprene Pharmaceuticals, a UMB startup developing novel small molecules for the treatment of cancer, sublicensed its technology to Hoth Therapeutics. Isoprene received an investment from UM Ventures and is under management by UM Ventures staff.

RECENT UM VENTURES SUCCESSES

KaloCyte, a startup developing a dried bio-inspired artificial red blood cell. relocated from St. Louis to UMB when its co-founders, Allan Doctor, MD, and Dipanjan Pan, MS, PhD, were recruited to establish the University of Maryland School of Medicine's new Center for Blood Oxygen Transport and Hemostasis and its Nanofabrication Core. Pan holds a joint appointment at the University of Maryland, Baltimore County. Since moving to Baltimore, KaloCyte has received UM Ventures support, raised \$950,000 in bridge funding, which included investment from the Maryland Momentum Fund (MMF), and is making progress on three active federal grants.

Medcura, a startup founded on technology from UMCP that infused field expertise from UMB, has developed an advanced materials platform, including Food and Drug Administration (FDA)approved textile and flowable hemostatic and wound treatment products. Exploiting the FDA's "Breakthrough Device" designation, the company raised \$10 million to support an initial launch of Rapid-Seal[™] in CVS stores in 2021, and is seeking the go-ahead from the FDA to begin testing its first implantable surgical product. Medcura has additional products for severe/traumatic bleeding in the development pipeline, such as LifeFoam[™]

and LifeDust[™]. A recent move into the company's new corporate headquarters in UMCP's Discovery District has enabled the establishment of Current Good Manufacturing Practice compliance to support commercial sales and all other product development and evaluation.

N5 Sensors, a UMCP startup, is a Maryland-based semiconductor sensor company leading the development of ultra low-power, selective microscale environmental sensors. These sensors are used in a variety of applications such as environmental monitoring, toxic chemical detection, industrial safety, and firstresponse use. The company has received eight Small Business Innovation Research (SBIR) awards and raised over \$2 million in capital from MMF and Blu Venture Investors. It has partnered with NASA, the Department of Homeland Security (DHS), and the Department of Defense, and was selected for the DHS "Smart City Internet of Things Innovation" pilot program for early detection of wildfires.

pathOtrak, a UMCP startup, developed a portable and easy-to-use device that shortens the time to test for pathogens in a food supply from 24 hours to four hours. It's on course to disrupt the \$10 billion food safety market with rapid, award-winning testing technology that uses a microfluidic chip to bypass timeconsuming processing steps to separate and test food-borne pathogens from unprocessed samples. pathOtrak recently completed a \$1.2 million seed funding round and was awarded a \$225,000 SBIR phase I grant from the National Science Foundation.

Protaryx, a UMB startup developing a device to access the left atrium during transcatheter cardiac procedures, launched with \$8.3 million in funding, including investment from UM Ventures. Protaryx was co-founded by James S. Gammie, MD, professor and chief of cardiac surgery at the University of Maryland School of Medicine and co-founder of Harpoon Medical, which was acquired by Edwards Lifesciences in 2017.

SurgiGYN, a UMB startup developing a uterine electrosurgical device to improve the safety and ease of total laparoscopic hysterectomy, was acquired by a leading global medical device firm in late winter 2020. UM Ventures provided early-stage investment and management, ultimately building the company to a point where it could be sold.

DELIVERING ENHANCED ACADEMICS AND MOVING MARYLAND FORWARD

The University of Maryland Strategic Partnership: *MPowering the State's* joint educational offerings fuse the strengths and complementary missions of UMB and UMCP to attract talented students, create a pipeline for student advancement, and meet workforce demands and students' needs for flexible training.

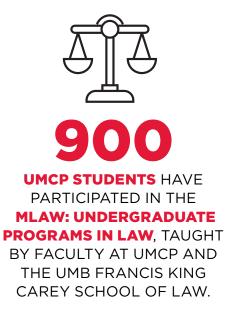


JOINT ACADEMIC COLLABORATIONS AT UMB AND UMCP, INCLUDING DUAL-DEGREE OFFERINGS, NEW DEGREES AND CERTIFICATES, GUARANTEED PATHWAYS TO ADMISSION, AND STUDENT ENRICHMENT PROGRAMS





UNDERGRADUATES HAVE WORKED WITH UMB MEDICAL FACULTY IN CAPSTONE AND CLINICAL EXPERIENCES COURSES.



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UMCP AND UMB STUDENTS HAVE CONDUCTED RESEARCH AT THE OPPOSITE CAMPUS THROUGH THE **UM SCHOLARS** PROGRAM.



MASTER OF SCIENCE IN LAW DEGREES HAVE BEEN CONFERRED IN SPECIALTIES, INCLUDING CYBERSECURITY LAW AND HEALTH CARE LAW.





NEW UNDERGRADUATE MAJORS IN **NEUROSCIENCE AND** IMMERSIVE MEDIA DESIGN HAVE LAUNCHED OR WILL LAUNCH AT UMCP IN 2020-2021.





At MPower Day 2020, students speak to legislators about the benefits of MPower's joint educational offerings.

NEW GRADUATE DEGREE PROGRAMS WERE CREATED: JOINT PHD PROGRAM IN BIOENGINEERING LAUNCHED IN FALL 2019; AND MASTER OF PROFESSIONAL STUDIES IN PUBLIC SAFETY LEADERSHIP AND ADMINISTRATION LAUNCHED IN FALL 2020

SELECTED EDUCATIONAL COLLABORATIONS

Bioengineering Joint Academic Programs

- UMB and UMCP's leadership in bioengineering and medicine creates tremendous opportunity for learning for students and faculty at both institutions.
- UMCP undergraduates team with faculty physicians at UMB to experience firsthand the robust link between engineering and human health.
- Students are exposed to the medical field and clinical settings, see the direct application of medical devices in a hospital setting, and then imagine and create their own engineering designs from concept to product.
- A joint PhD program in Bioengineering the MPower Graduate Fellowship — spans both institutions and offers students an opportunity to create and deliver engineering solutions to challenging, clinical problems related to medicine, pharmacy, or dentistry.

MLAW: Undergraduate Programs in Law

- The MLAW programs offered at College Park give students early exposure to ideas, mentors, and professional opportunities in law not normally available to undergraduates.
 Faculty from the UMCP
- College of Behavioral and Social Sciences and the College of Arts and Humanities as well as the UMB Carey School of Law teach a variety of subjects such as immigration and crime, global environmental law, health law, and structural racism and housing.

Master of Science in Law (MSL)

- Designed for working professionals, the MSL is a master's-level education in law, policy, and regulations, taught by UMB Carey School of Law faculty.
 The 5-year-old program
- offers specializations in health law, environmental law, cybersecurity law, and homeland security and crisis management law.
- The program targets those in highly regulated fields as seen in state and federal agencies, corporations, and not-for-profit organizations.

Policing and Public Safety Administration

- Launched in fall 2020, this new master's degree and certificate program in public safety leadership and administration targets personnel in law enforcement, first response, social services, and other public safety professions.
- Developed by faculty from UMCP's College of Behavioral and Social Sciences' departments of sociology and criminology and criminal justice, and UMB's Carey School of Law, this program responds to an increasing need for advanced training in leadership, policy, and law for police and public safety officials and other public servants.

University of Maryland Center for Economic and Entrepreneurship Development (UMCEED)

Established by law in 2016, UMCEED increases workforce readiness by creating educational degree programs in high-impact fields such as neuroscience, virtual and augmented reality, biomedical devices, data analytics, and cybersecurity.

- In 2020, the Visiting Fellows in Neuroscience Program launched to offer cross-campus training in neuroscience. Graduate students at UMB and UMCP are working with research groups at the opposite campus to acquire new techniques and broaden their training.
- The Colleges of Behavioral and Social Sciences and Computer, Mathematical and Natural Sciences (CMNS) launched a new, undergraduate neuroscience major at UMCP in fall 2020 to train students interested in health care, allied health careers, biomedical industries, and clinical psychology. This is the first intra-college major offered at UMCP.
- A new bachelor of science and bachelor of arts degree in immersive media design offered by UMCP's Colleges of Arts and Humanities and CMNS is on track to launch in 2021. A unique collaboration between science, technology, engineering, and math (STEM) fields and the arts and humanities, the degree prepares students to be leaders in the

production of augmented reality, virtual reality, and immersive media design disciplines.

UM Scholars

- This dynamic 10-week research program connects students from UMB and UMCP to faculty mentors at the opposite institution to work on projects designed to expand students' knowledge and open their eyes to other fields.
- Summer 2020 programs included a new interdisciplinary research program on health literacy and student placements with the Maryland Department of Health.
- More than 160 students have reaped the benefits of tailored faculty mentoring in topics such as health science, public health, law, and social work.



Bioengineering Clinical Experiences Course

Bioengineering Capstone Design Competition



UM Scholars

COVID-19 restricted in-person research during the 2020 UM Scholars program, but it didn't diminish the impact the experience had on students.

Throughout the summer, I was surprised how much I learned about myself and how it has influenced my future career plans. Prior to this internship, it

felt like I had many career interests and yet had no clear choice. \bigcirc

- Alexandra Wilson, School of Pharmacy, expected graduation 2023



UM Scholars and faculty mentors catch up in Annapolis at MPower Day 2020.

Being part of UM Scholars helped me reinforce my research skills and gave me the chance to acquire new ones. I even found a new passion for applying computer science concepts to answering the biggest biomedical guestions.

 Rodrigo Sandon, College of Computer, Mathematical, and Natural Sciences, expected graduation 2021 This program has allowed me to pursue research, which has been incredibly fulfilling, and to create connections with community partners and professors that I would never have been able to meet otherwise.

- Jace Huber, School of Social Work, expected graduation 2021

My experience in the UM Scholars program has been a very memorable one that **not only exposed me to clinical research** but also **allowed me to advance my knowledge in research** through participating in workshops and attending seminars. As a result of the program, I am even more strongly pursuing a career in medicine that involves clinical research as a key component.

> — Jayna John, College of Agriculture and Natural Resources, expected graduation 2021

The program solidified my growing interest in social science research. It made me start to think about different career paths available to

me to incorporate research into my future plans as a social worker.

- Sakiera Malone, School of Social Work, expected graduation 2021

I had planned to pursue a career in dentistry and was interested in microbiological research. Through the guidance of my mentor and UM Scholars seminar programming, I discovered new interests in infectious diseases and immunology. I have now shifted my desired career path to a MD/PhD track, through which I can combine my passion for both patient care and research.

> Madison Tewey, College of Computer, Mathematical, and Natural Sciences, expected graduation 2021

SERVING MARYLAND — AND BEYOND

The University of Maryland Strategic Partnership: *MPowering the State* brings together top thinkers from multiple branches of expertise in health, science, law, and social science to redefine challenges and devise solutions that make a positive impact in Maryland and on society at large.

AGRICULTURE LAW EDUCATION INITIATIVE (ALEI): Educating and serving Maryland family farmers through expert information and training to help navigate complex legal issues such as estates and trusts, regulatory compliance, farm food safety, and other aspects of agriculture law.

ALEI reaches the state's agricultural community through publications, social media, trainings, and formal classroom education. ALEI hosts a popular annual conference on agriculture and environmental law that addresses current legal issues impacting Delmarva's communities. In 2020, the event moved online and was able to reach an even larger audience. Undergraduate students at UMCP and law school students at UMB benefit from classes taught by legal specialists on agriculture and law. At the onset of COVID-19, ALEI quickly mobilized to provide answers to farmers grappling with rapidly changing regulations and the effects on agricultural operations. Subjects included labor issues and managing contracts canceled due to COVID-19.



ALEI provided farmers like Laura Beth Resnick of Butterbee Farm with specialized assistance to navigate COVID-19 and its impact on farm operations.

SUPPORT, ADVOCACY, FREEDOM, AND EMPOWERMENT (SAFE) CENTER FOR HUMAN TRAFFICKING SURVIVORS: Combating human trafficking through direct services, research, advocacy, and training.

The SAFE Center is the first systematic, university-based program to serve victims of human trafficking with comprehensive legal, social, economic empowerment, mental health, and medical services. Since its founding in 2016, it has served 165 survivors of human trafficking plus families of victims. The SAFE Center has attracted substantial public and private grant funding. It received a joint \$1.3 million U.S. Department of Justice grant with the Prince George's County Police Department, and two Maryland Governor's Office of Crime Control and Prevention grants totaling almost \$1.2 million to provide services to survivors of sex and labor trafficking in Maryland. The center also received several large grants of up to \$100,000 from private foundations. Nine UMB and UMCP schools and colleges are engaged, and 70 students have served internships at the center, helping to deliver client services, develop programs and curriculum, conduct outreach, and provide research. The SAFE Center has leadership roles on state and county human trafficking task forces and is an essential partner to Maryland government agencies, law enforcement, private industry, and nonprofit organizations.



Maryland Attorney General Brian Frosh delivers the keynote address at a SAFE Center symposium on labor trafficking in January 2020.



ARTS & HUMANITIES SOCIAL WORK INFORMATION STUDIES Computer Science **EDUCATION** Anatomy and Neuroscience LAW Chemistry and Biochemistry Orthopaedics AGRICULTURE ENGINEERING Biochemistry and Molecular Biology **BUSINESS** JOURNALISM Psychiatry DENTISTRY Sociology PUBLIC POLICY Pathology Program in Trauma BEHAVIORAL AND SOCIAL SCIENCES Science of Pain MEDICINE Program in Cancer Bioengineering NURSING Biology Geographical Sciences Kinesiology Criminology and Criminal Justice PUBLIC HEALTH Epidemiology PHARMACY Psychology Government and Politics **Cell Biology and** COMPUTER, MATHEMATICAL, **Molecular Genetics** AND NATURAL SCIENCES

Hearing and Speech Science Diagnostic Radiology and Nuclear Medicine

MPOWER AT A GLANCE

LEADERSHIP

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CURRENT PROGRAMS AND INITIATIVES

Agriculture Law Education Initiative (ALEI)

Bioengineering Capstone Design Course

Bioengineering Clinical Experiences for Undergraduates

Bioengineering Joint PhD

Center for Brain Health and Human Performance at Cole Field House

Center for Health-Related Informatics and Bioimaging (CHIB)

Collaborative, Cross-Institution Academic Degree Pathways to Multiple Schools and Colleges

Collaborative Research Proposals

COVID-19 Pandemic: Research and Medical Device Challenges

Institute for Bioscience and Biotechnology Research (IBBR)

Joint Research and Innovation Seed Grant Program

Maryland Blended Reality Center (MBRC)

Maryland Center for Advanced Molecular Analysis (M-CAMA) Maryland Center of Excellence in Regulatory Science and Innovation (M-CERSI)

Maryland Cochlear Implant Center of Excellence (MCICE)

Master of Science in Law (MSL)

MLAW: Undergraduate Programs in Law

National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL)

Opioid Use Disorders Research Collaboration

Policing Partnership: Master of Professional Studies in Public Safety Leadership and Administration

Robert E. Fischell Institute for Biomedical Devices

SAFE Center for Human Trafficking Survivors

Social Work Program Expansion at Shady Grove

Visiting Fellows in Neuroscience

University of Maryland Center for Economic and Entrepreneurship Development (UMCEED)

UM Scholars

UM Ventures/Center for Maryland Advanced Ventures (CMAV)



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