# 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 20232. 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](quantum.umd.edu).