



Next:

Frontiers in Precision Health



University of Massachusetts



Accelerating device development

The joint UMass Medical School / UMass Lowell Center for Advancing Point of Care Technologies (CAPCaT) received a \$120 million grant from the National Institutes of Health to lead the nationwide Rapid Acceleration of Diagnostics (RADx) Tech initiative, which is racing to bring 20 new point-of-care diagnostic devices through the regulatory process.

Genomics

An individual's genes provide both a map to his or her risk for many diseases and a means of highly targeted treatments. UMass has great system-wide strength at the intersection of genomics and medicine.

UMass is a world leader in genomics-based therapies, from the basic science to licensed drugs. The medical school's RNA Therapeutics Institute

Mello, who discovered the RNA



UMass Amherst's Institute for Applied Life Sciences houses the Center for Bioactive Delivery, the Center for Personalized Health Monitoring, and the Models to Medicine Center.



nanotechnologies) and integrative analytics to well-curated human samples in order to clarify biological pathways, provide insights into disease mechanisms, identify new therapeutic disease or response to therapy.

UMass Amherst also houses a DNA and RNA analysis core facility, the Genomics Resource Laboratory, within its Models to Medicine Center, part of the university's \$150 million Institute for Applied Life Sciences.

Digital health

Point-of-care and personal devices are increasingly being used to

information in real time and real-life

apps on smart devices can be used to track nutrition, physical activity, blood pressure, and more. Continuous measurement of this kind is vastly more informative than point-in-time measurements taken at the doctor's

The UMass Center for Digital Health, a partnership across the Boston, Lowell, and Worcester campuses, is the system's hub for digital health

innovation. The center has millions of dollars in active research grants from National Science Foundation and the National Institutes of Health,

NIH grant to improve tuberculosis diagnostics using deep learning-based approaches and mobile health technologies.

UMass is at the forefront of medical device development and manufacture in the Commonwealth. UMass

Amherst's Center for Personalized Health Monitoring, a \$46 million, state-funded arm of the Institute for Applied Life Sciences, accelerates the

of low-cost, multi-function, wearable, wireless sensor systems

eyeglasses that track eye movements indicative of cancer-related fatigue, which help cancer survivors manage



during more than 78 million healthcare encounters. One user: the UMass Center for Microbiome Research. Center faculty partnered with Philips Healthcare to create a cloud-based engine that can use genomic signatures of bacteria collected from patients and

e-Exercise against cancer

Breast cancer is disproportionately deadly for Black women. UMass Boston Exercise Science Chair Julie Wright is exploring whether a digital exercise program for Black breast cancer survivors and their at-risk relatives can help improve their outcomes. During Wright's 50-person pilot project, funded from the NIH's \$17.8 million grant to the UMass Boston/ Dana Farber-Harvard Cancer Center Comprehensive Partnership for Cancer Disparities Research, participants will help her design a computer or mobile based intervention that will help them hit recommended exercise goals—and hopefully fend off cancer.



two other universities to create a “storytelling” online consent platform designed to engage more African and

In a \$2 million study funded by the National Cancer Institute, fellow medical school faculty members Sarah Forrester and Ann Moormann are also studying the power of storytelling to engage minorities in research—in this

case, using narrative videos to increase representation of Black and Hispanic people in COVID-19 immunology and vaccine research.

Precision health workforce

In a recent national survey, medical professionals were enthusiastic about the potential of new technologies to transform healthcare but also

reported that the medical education they received did not fully prepare them to be data-driven doctors. UMass is committed to preparing

workforce capable of advancing data-driven healthcare. A host of innovative trans-disciplinary training programs

students, residents, fellows, and practitioners with both technical and clinical skills.

- At UMass Boston, the \$5.1 million NIH-funded Comprehensive Partnership for Cancer Disparities Research has trained

students from largely underrepresented populations in molecular biology and cancer research, enabling them to compete successfully for post-graduate degree programs and industry careers in the local life sciences cluster. Dana-Farber and Harvard University partner with UMass Boston to mount an innovative research and educational program

to increase the presence of minority researchers and medical professionals. Senior faculty mentor undergraduates, guiding them toward research careers focused on cancer, health disparities, and biomedical science.





UMass is training students across the state to join the precision health workforce.

- UMass Dartmouth's data science bachelor's and master's degree programs data scientists, including those in precision health.
- UMass Amherst's Center for Data Science offers an MS concentration and a master's

The university's Biomedical Engineering Department, launched in 2017, educates more

year, and has strong doctoral and research programs, with several faculty labs located at the UMass Medical School. UMass Amherst also offers an Integrated Concentration in Science program that trains the university's most promising STEM majors to be silo-breaking problem solvers, leaders, and innovators in science and technology, with a focus on biomedicine.

The campuses are also feeding the computing science pipeline. UMass Lowell's CS Pathways program is a \$1 million, National Science

- UMass Lowell's Biomedical Engineering Program prepares students for careers in the medical device, pharmaceutical, and biopharmaceutical markets,

undergraduate degree program in biomedical engineering in Massachusetts.

Tomorrow's frontiers

UMass's strengths in genomics, data science, artificial intelligence, medical device development, and population medicine today are setting the stage for big advances in precision health tomorrow. Here, we highlight five vital research frontiers that UMass will be pursuing over the next five to ten years.

Next frontier 1:

Create genomics-informed disease prevention, diagnosis, and treatment plans

The coming decade will see the emergence of precision genomics: the application of genetic data for

and treatment. Drawing on our

data analysis, UMass is poised to create a bench-to-bedside model of genomics-informed patient care for a range of common and rare diseases, including diabetes, cardiovascular disease, cancer, mental illness. Our efforts will bring together researchers studying the role of genomic variation in human health with those who

diagnostic and prognostic protocols, gene and RNA-based therapies, and other approaches to predict, prevent, and treat disease.

Next frontier 2:

Design next-generation, useful, and usable digital health technologies

The development of 5G (and then 6G) wireless networks, with their capacity to transmit huge amounts of data at rates 10 to 100 times faster than 4G, promise to supercharge "smart" medical devices, opening the door to fast processing and sharing of high-resolution images, enhanced telehealth, longterm remote monitoring, and more. UMass will bring together technologists, clinicians, and behavioral scientists to develop digital health monitoring, imaging, and AI-enabled data processing tools that take advantage of advances in computing power to

in ways that improve patient health and clinician productivity.

This work has already begun. UMass Dartmouth's Internet of Things and Data Engineering Lab is currently developing a 5G wireless body-sensor system that could be used for detecting and predicting life-threatening events, monitoring illicit drug use, and biosensor-based

Next frontier 3:

Translate complex health data into actionable knowledge

Any advancement in precision health will require advanced data mining, and UMass will be increasingly focused on

from longitudinal patient data from

electronic health records, point-of-care devices, mobile health apps, and more to improve medical decision making. This work will follow from projects like UMass Boston's Oregon - Massachusetts Mammography Database (OMAMA-DB), recipient of a \$750,000 Bits to Bytes grant from the Massachusetts Life Sciences Center (Ne)T.J.4 Tdϕhe Mass0 -1.d(a \$750)16 g ev

quantum computing will transform data analysis and AI-enhanced decision-making, turbo-charging drug design, DNA sequencing, and all aspects of precision medicine that require the crunching of big data.

Next frontier 4:

Use data and technology to improve health equity

The advances described above are

care must be taken that they leave no individual or population behind. UMass will partner with the members

Supplying the hub of the precision health industry

One-size-fits-all medicine is expensive. Treatments based on what is effective for the average patient—rather than what genetics, medical history, and circumstances suggest would work best for *this* patient—can have a significant failure rate, leading to more visits, more treatments, and longer sickness.

Medicine Commission put the annual cost of sickness and death related to prescriptions that don't work, cause problems, or aren't taken at between \$4.9 and \$6.7 billion. Precision medicine promises to increase

while improving outcomes.

Precision medicine is also spurring developments in genetics-based pharmaceuticals and digital medicine platforms and devices. Market

precision medicine market, valued at about \$58 billion in 2019, to reach as much as \$141 billion by 2027, largely

cancer approaches like immunology.

North America dominates this market today, according to a 2020

Visiongain report, and Massachusetts 2019 forms and decisions in Massachusetts, v

Dig deeper

Research related to precision health is happening in labs and centers across the University of Massachusetts. Visit the links below to find out more about the work going on our campuses and the researchers conducting it.

Genomics

Genomics Resource Laboratory (Amherst)

www.umass.edu/ials/genomics

Models to Medicine Center (Amherst)

www.umass.edu/m2m

Center for Personalized Cancer Therapy (Boston)

www.umb.edu/cpct

Program in Human Genetics & Evolutionary Biology
(Worcester)

Integrative Biomarker Center (Worcester)

www.umassmed.edu/InBioCenter



