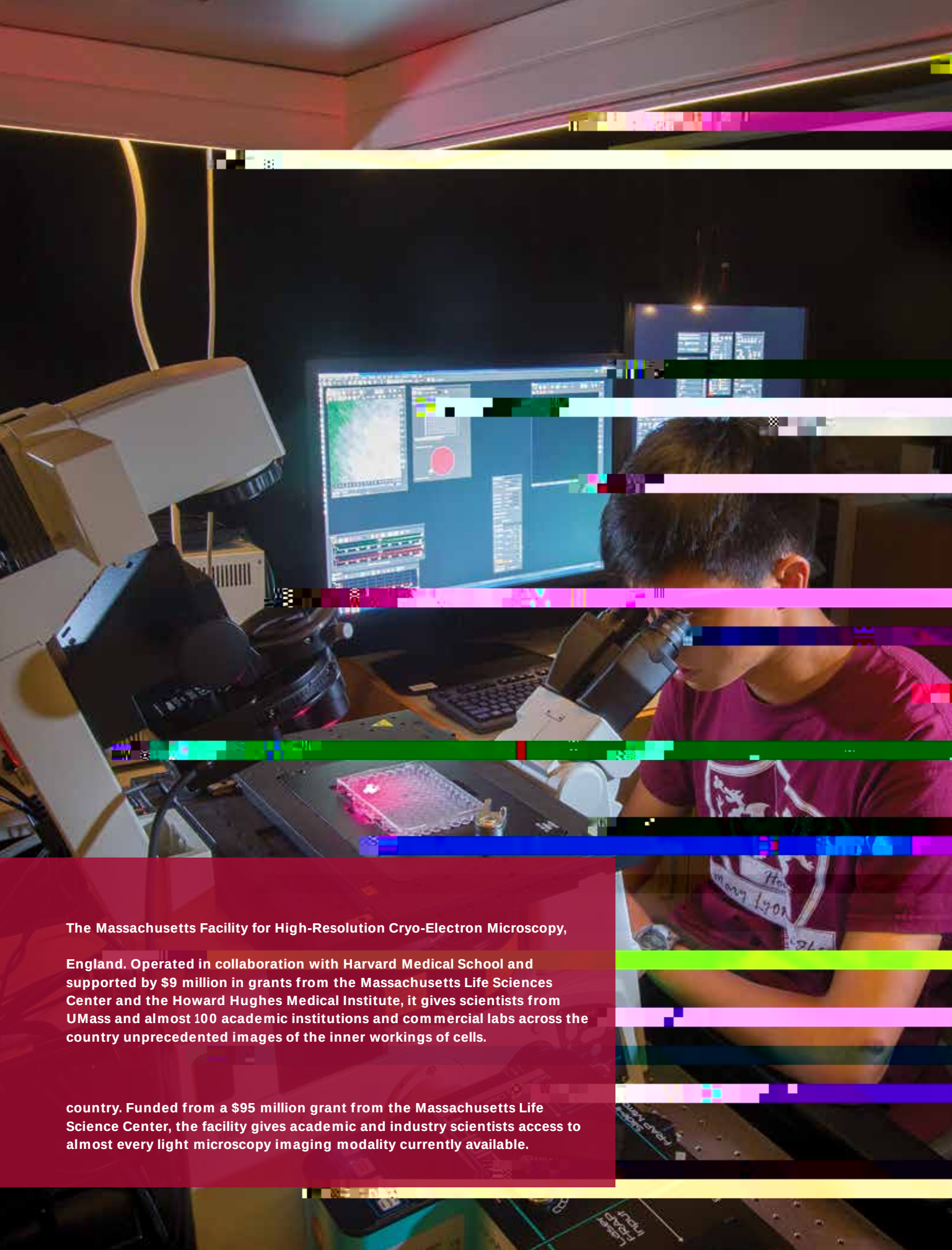

UMASS
University of Massach



The Massachusetts Facility for High-Resolution Cryo-Electron Microscopy,

England. Operated in collaboration with Harvard Medical School and supported by $9 million in grants from the Massachusetts Life Sciences Center and the Howard Hughes Medical Institute, it gives scientists from UMass and almost 100 academic institutions and commercial labs across the country unprecedented images of the inner workings of cells.

country. Funded from a $95 million grant from the Massachusetts Life Science Center, the facility gives academic and industry scientists access to almost every light microscopy imaging modality currently available.

Gene therapy and RNA interference (RNAi) therapy—which harnesses the body's genetic processes to ćőŊŹŭőŕŹĭđŪŭőčžćŹıőŊőǂčıűđîűđ。 causing proteins—are at the forefront of drug development today. By blocking genetic diseases at their source, researchers are working to revolutionize treatment for wide range of currently incurable conditions, ıŊćŃžčıŊħ q¿-ćհűŹıćOĆŭőűıű-îŊč muscular dystrophy.

Çĭđ Ì wîűű űhհűŹđ'n:ŃđîčűŹĭđƠđŃčıŊ both the development and delivery of these therapies. Craig Mello, distinguished professor in the UMass Medical School's RNA Therapeutics Institute (RTI), effectively launched Źĭđ»x ıƠđŃčıŊ'>><-GʹĭđŊĭđćő。 published a paper describing the RNA interference mechanism, a discovery for which he was awarded the Nobel Prize in 2006.

»Ç˜7ĭîıŭ ¸ĭıŃıŪêî'nőŭđ-îˆGʹőŭŃč。 renowned expert in gene regulation ŊđŹGʹőŭłű-čđƒđŃőŪđč˙ŹĭđOŭűŹ»x ı drug approved for use by the FDA. His discovery transforms the lives of the 50,000 people diagnosed with hATTR amyloidosis each year.

Guangping Gao, di6.1 (,)15 tŐP,1ðivfessor s the livel (or us45.4 Td(or us45.(drug an(or (o0s)C

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Sustainable Marine Aquaculture program at UMass Boston is dedicated to securing future seafood supply, and the UMass Amherst Food Science Department is developing plant milks, ŊžŹŭıźıőŊîŃĥŭ ćő'nŪŃđŹđ ŪŃîŊŹ¸Ćîűđč ¸'nđîźű-¸ îŊč NîĆ¸ĥŭőGŊ 'nđîŹ·Çǐđűđ "future foods" offer health, ethical, and environmental advantages, including ŭđčžćıŊĦ Źǐđ ćǐîŊćđű őĦ îŊı'nîŃ¸ Źő¸ǐž'nîŊ čıűđîűđ ŹŭîŊű'nıűŭıőŊ- like the infection that launched the coronavirus pandemic.

biologics, such as therapeutic proteins, antibodies and RNA molecules, inside cells.

Beyond simple sustenance, food undergirds and undermines human ǐđîŃŹǐ· îŊč· GđŃ¸ĆđıŊĦ·ıŊ GΎîhűű that still aren't fully understood. Research shows that poor diet, for example, is implicated in chronic diseases affecting 17 million adults in America today—but the physiological mechanisms connecting diet and disease are unclear.

The relationship between nutrition and health is a major research focus of UMass Lowell's Biomedical and Nutritional Sciences Department and of UMass Medical School, at both the dietary level—in the medical school's Center for Applied Nutrition—and at the biochemical level.

It is also a one of many topics studied by the Department of Food Science at UMass Amherst, which was one őĦ Źǐđ ŌŭűŹ Ħőőč· űćıđŊćđ Ūŭőĥŭîn'nű in the country and today boasts the #1 PhD research program in the nation. The department's Food Safety group conducts research addressing pathogens and contaminants in the food industry, including the development of sensitive and rapid detection methods, creating mathematical models to assess and predict microbiological hazards, uncovering potential toxicological

đĦĦđćŹűő őĦ đîŹıŊĦ·Ħőőč¸ĥŭîčđ nanoparticles, and the use of natural products to control bacterial growth.

Trillions of bacteria of different kinds live in our stomachs and intestines, outnumbering our own cells many times over. In 2014, the Center for Microbiome Research—a collaboration between UMass Medical School, UMass Amherst's Life Sciences Laboratories and the UMass Dartmouth Center for Scientific Computing and Data Visualization Research—was created by UMass Medical School bacteriologist Beth ẇć7őŭ'nıćl· îűî·úłwűŹđ'n¸Gıčđ đĦĦőŭŹ Źő· čđűıhŊ 'nıćŭőĆıő'nđ¸Ćîűđč· 'nđčıćîŃ treatments.

7đŊŹđŭ ŭđűđîŭćǐđŭű Gđŭđ ŹǐđŌŭűŹ in the world to discover probiotic assemblies that inhibit multidrug resistant germs, as well as microbiome "signatures" (particular compositions of species of gut microbes) that predict dementia status, including in Alzheimer's disease. These kinds of ŎŊčıŊĥű őŪđŊ žŪ đƳćıŹıŊĦ·ŊđG̊ îƒđŊžđű for disease prevention and treatment.

UMass Dartmouth's Cranberry Health Research Center is studying the ı'nŪîćŹ őĦ·Źǐđ 7ő'n'nőŊGđîŃŹǐ¸ű Ńîŭhđűź crop on the microbiome, and on health issues ranging from urinary tract infections to cancer treatment.

Another key focus for UMass food researchers is creating sources of nutritious food for the future. The

After immunotherapy begins, patients face an anxious wait of weeks until the

whether it is working. UMass Amherst chemical engineer Ashish Kulkarni has developed a bioluminescent marker molecule that slashes that wait to hours.

they detect the enzymes immune cells release to kill cancer. If imaging reveals lit sentinels in the tumor, the therapy is working. If not, the oncologist can immediately try another approach, losing

to develop a rapid and generalized detection of viruses for handling future pandemics. The Institute for Applied Sciences at UMass Amherst [illegible] Clinical Testing Center initially used [illegible] clinical tests. The center's resources are available to all UMass researchers developing new clinical tests and to industry partners needing to validate new sensors, biomarkers, and even therapeutic candidates in a validated clinical test laboratory.

Faculty across the system have pivoted existing research in the direction of COVID. For example, UMass Boston [illegible] disease biomarkers to test for emerging diseases, began adapting her [illegible]

UMass Medical School biochemists [illegible] Response Initiative awards from the Harrington Discovery Institute in Cleveland, Ohio—two of only 12 recipients chosen from applications [illegible] institutions. Fitzgerald is investigating therapies for lung injury related [illegible]

the replication rate of COVID and [illegible]

[illegible] saving therapeutics to market is the mission of MassBiologics. Founded by the medical school, it is the only [illegible] manufacturer in the United States. The MassBiologics team has brought more than 20 licensed products to market, including some critical vaccines. The medical school also operates the Institute for Drug Resistance, the only organization in the world focused on [illegible] research to speed the delivery of [illegible] circuit drug resistance.

Conventional cancer therapy is an exercise in managing collateral [illegible] enough toxic drugs to kill cancer cells without killing too many healthy ones. Emerging cancer immunotherapies activate the patient's own immune [illegible] tumors, not the whole body—an approach that's gentler and can eradicate certain cancers within weeks.

UMass has strength in cancer research across the system, including in many avenues of immunotherapy.

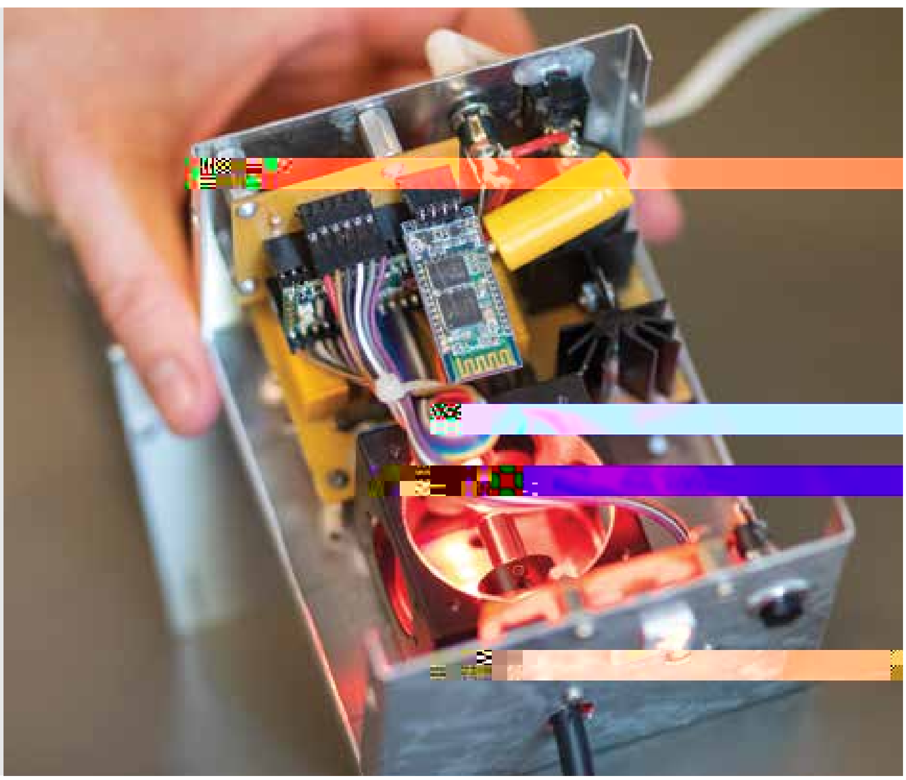
In 2008, UMass Boston was awarded $10 million from the Massachusetts Life Science Center to support the Center for Personalized Cancer Therapy, a collaboration with the [illegible] UMass Medical School's Cancer Center of Excellence is a collaborative venture with UMass Amherst that takes a personalized approach to cancer treatment, centering research on the premise that the molecular underpinnings of every tumor are distinct.

One exciting area of immunotherapy research—the use of nanoparticles to deliver drugs directly to tumors and to enhance the effectiveness of radiotherapy—draws on the system's strength in cancer research and the wealth of polymer and medical physics expertise at UMass Amherst [illegible] storm that is the major risk of immunotherapy. UMass Dartmouth bioengineer Steven Zanganeh is also taking a nanoparticle approach, studying whether iron oxide nanoparticles can inhibit tumor growth by provoking an immune response.

As faculty across the UMass system pivot their research to address Źĭđ 7 ~ à`= ˳‘>˙ ćŭűıű- ıŊ ƠđŇčű ĦŭőʼnṄ manufacturing to communications to medicine, they are living Źĭŭőžħĭ˙ ĩ˙ŭđĩŇ˳Źıʼnđ ćŭĩűĭ˙ ćőžŭűđ ıŊ contending with global infectious disease pandemics. While tragic, the coronavirus has revealed research avenues and programs that are particularly important and effective in the context of a global health crisis.

Çĭıű ıŊćŇžčđű űıħŊıƠćĩŊŹ Ŋđđčű ıŊ public health training and education. One example that proved invaluable: Źĭđ ćőŊűıűŹđŊŹŅ ĩććžŭĩŹđ ʼnžŇŹı˳ʼnőčđŇ ơž˙ĦőŭđćĩűŹıŊħ˙ʼnđŹĭőčőŇőħŅ őĦ Ì wĩűű Amherst biostatistician Nicholas Reich, which led the Centers for Disease Control and Prevention to establish one of the nation's two CDC In f uenza Forecasting Centers of Excellence at UMass. Using the same approach, »đıćĭ˙ ćŭđĩŹđč 7 ~ à`= ˳‘>˙ ĦőŭđćĩűŹű Źĭĩ Ź were used by both the CDC and the White House Coronavirus Task Force.

Through the remainder of this pandemic and beyond, we will look Ćĩćŀ ĩŹ őžű ĭĩŭč˳ĞőŊ ŀŊőĞŇđčħđ ĩŊč derive best practices for pandemic response, with particular focus on rapidly evolving strategies to test for pathogens and generate antibodies against them. We will also continue to follow promising leads for treating existing communicable diseases, like UMass Amherst chemist Jeanne



Massachusetts is the hub of the US life sciences industry. According to the Massachusetts

and was home to $4.1 billion in venture capital investment in 2018. Massachusetts researchers

operate 35.2 million square feet of lab space, up by 91 percent in the last 10 years.

UMass excels in the translation of research advances to consumer products. The system ranks third among US universities in licensing revenue, and has launched an ı'nŪŭđűűıƒđ ŭőűŹđŭ őĦ űŪıŊ¸őĦĦ companies, including:

- Alnylam Pharmaceuticals
- ApicBio
- Arret
- Aspa Therapeutics
- Atalanta
- Bacainn biotherapeutics
- Fulcrum Therapeutics
- PTC Therapeutics
- RXi Pharmaceuticals
- CRISPR Therapeutics
- Cyta Therapeutics
- Ernest Pharmaceuticals
- Felsuma
- Generation Bio
- Intellia Therapeutics
- Villaris Therapeutics
- Voyager Therapeutics

Today, 463,500 people in the Commonwealth work in the life sciences. Over the next ten years, employment in that industry is expected to grow by more than 7 percent—nearly double the state's projected overall employment growth. Massachusetts life science employers ĠıŃ ŊđđČ Źő ƠŃ 'nőŭđ Źĭ îŊ ' ʾ-" " "ľőĆű by 2030.

á ĭđŭđ ĠıŃ Ġőŭŀđŭű Ůž îŃƠđČ Źő ƠŃ Źĭđűđ ŪőűıŹıőŊű ćő'nđ ĦŭőʼnˆʹŊ the Commonwealth, the majority will be graduates of the Universinɓ PP,nƁPőƁɓPP,nƁ,•PQɓ / ő33TeGeneration Bio

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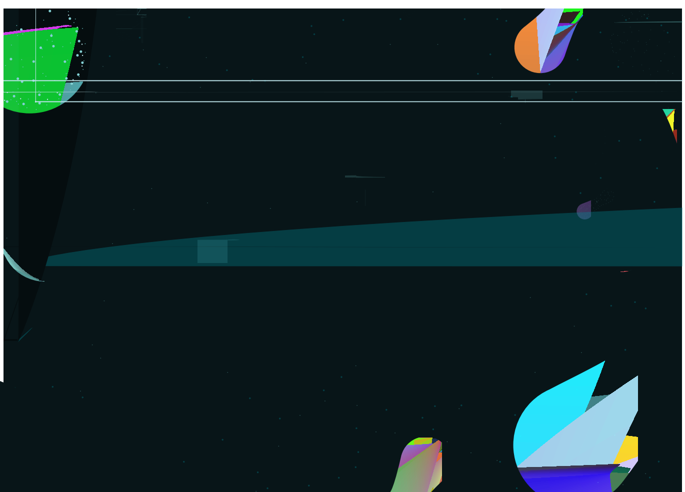
We look to industry as partners to bring these discoveries to market and enable millions of [illegible] complete the arduous process of clinical trials remains a critical problem for everyone in the [illegible] life sciences.

We know that government (especially the National Institutes of Health, but other institutions as well) is there to amplify the importance of the work we do, and to help us support the next generation of scientists who will execute on these grand challenges. And what better location [illegible] union for this kind of work. The University of Massachusetts is proud to serve as a vital backbone for these advances.



Applied life sciences research is happening in labs and centers across the UMass

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