**For NIH applications, Facilities & Other Resources** should identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. **Describe only those resources that are directly applicable to the proposed work. A list of links for each facility is provided if further information is needed.**

**FACILITIES & OTHER RESOURCES:**

**UMass Chan Medical School**

The University of Massachusetts Chan Medical School (UMass Chan), one of five campuses of the University of Massachusetts system, comprises the T.H. Chan School of Medicine; the Morningside Graduate School of Biomedical Sciences; the Tan Chingfen Graduate School of Nursing; ForHealth Consulting, a public service consulting division; and MassBiologics, the only nonprofit, FDA-licensed manufacturer of vaccines, biologics and viral vector gene therapies in the United States. UMass Chan’s mission is to advance the health and wellness of our diverse communities throughout Massachusetts and across the world by leading and innovating in education, research, health care delivery and public service. In doing so, it has built a reputation as a world-class research institution and as a leader in primary care education, perennially ranked in the top 10 percent of medical schools for primary care by U.S. News and World Report. UMass Chan attracts more than $300 million annually in research funding, placing it among the top 50 medical schools in the nation. In 2021, the Medical School received a $175 million donation from The Morningside Foundation and was renamed UMass Chan Medical School.  UMass Chan is home to more than 7000 employees, including 3,975 full and part-time faculty, 750 medical, 363 biomedical sciences, and 218 graduate nursing students in 2024.

**RNA Therapeutics Institute (RTI)**

The RTI (<http://www.umassmed.edu/rti/index.aspx>) was founded in 2009 and became an academic department in 2016, chaired by Phillip D. Zamore, Ph.D. The RTI is dedicated to leveraging the strong RNA biology and clinical research communities at UMass Chan to develop novel therapies for which RNA is the therapeutic target or the drug. RTI faculty are recognized as scientific trailblazers, and include a Nobel Laureate and Gairdner Prize recipient, and two Howard Hughes Medical Institute Investigators.

The RTI comprises a key component of the UMass Chan Advanced Therapeutics Cluster, which also includes the Neurotherapeutics Institute and the Horae Gene Therapy Center. The Neurotherapeutics Institute is co-directed by RTI faculty member Neil Aronin, M.D. and Robert Brown, M.D., D. Phil., who chairs the Department of Neurology. The RTI’s close affiliation with the Neurotherapeutics Institute and the Horae Gene Therapy Center provides an unparalleled intellectual environment in which to accomplish the common goal of developing novel therapeutics.

By interweaving basic and applied nucleic acid scientists with clinicians dedicated to finding new cures, RTI’s goal is to create a new paradigm for organizing molecular research that enables the rapid application of new biological discoveries to solutions for unmet challenges in human health. By uniting researchers studying the fundamental biology and mechanisms of cellular RNAs with those working to devise human therapies using or targeting nucleic acids, the RTI represents a new model for scientific exploration.

As an academic department, the RTI fosters the development of well-rounded scientists—both faculty and trainees. The RTI regularly hosts seminar speakers who are leaders in their fields of research; every other week RTI faculty and their laboratories gather on afternoon for tea and lively discussions, or during lunchbreak for chalk talks; and RTI students and postdocs organize a monthly RNA Club, wherein faculty, postdocs, and students from RNA research groups throughout campus discuss their unpublished data and ideas. Many RTI faculty hold joint appointments in other departments, providing additional opportunities for their trainees to present their work and to network with peers and faculty throughout campus.

RTI scientists and trainees are supported by a staff of administrative and financial professionals.

**Albert Sherman Center**

The Albert Sherman Center (ASC), home to the RNA Therapeutics Institute, is a state-of-the-art research and educational facility. Completed in 2012, the 512,000-square foot facility nearly doubled the research capacity of the Worcester campus. When fully occupied, the ASC will house some 90 principal investigators and their laboratory programs, including more than 700 scientists, graduate students, and support staff. The ASC is primarily devoted to biomedical research, with six floors of research laboratories, core facilities, offices, and conference spaces; the remaining three floors provide designated educational space. Advanced technologies integrated into the structure and operation of the ASC, which earned LEED Gold certification, will improve energy efficiency by 25% compared to a similar sized building of standard design, by reducing energy consumption by 4.1 million kilowatt hours and carbon dioxide emissions by 4.5 million pounds annually.

The ASC was designed to maximize collaboration among scientists, educators, and students across scientific disciplines. The Department of Genomics and Computational Biology, directed by Professor Zhiping Weng, for example, is housed in space contiguous to the RTI, which facilitates productive interaction and collaboration between the departments. The open laboratory design also promotes interaction between basic scientists exploring fundamental questions in biology and clinical researchers studying mechanisms of human disease. The result is a novel approach of bench-to-bedside—i.e., translational—research that aims at developing innovative therapies for a wide range of diseases, including cancer, cystic fibrosis, and neurodegenerative diseases. For example, scientists and physician-scientists passionate about curing neurodegenerative disorders, such as Huntington’s Disease, are working together to characterize the genetic basis of disease; to investigate the molecular and biochemical mechanisms of disease; to seek DNA- or RNA-based therapies to control disease; to engineer delivery vehicles for advanced therapies; and to treat patients while exploring potential cures for their diseases.

**Core Facilities**

UMass Chan has a wide range of research support core facilities. A brief description of the services provided by each core facility and other basic internal resources are provided below.

***Animal Models***

**Animal Medicine** operates four animal housing facilities on the University campus totaling 118,550 square feet. Animal housing facilities offer species-appropriate, environmentally controlled and monitored housing rooms. Designated procedural rooms are equipped with laminar flow hoods for research use. The Department of Animal Medicine provides daily husbandry and veterinary care for approximately 90,000 animals.  The department has approximately 75 employees, including 42 animal care technicians, 7 veterinary technicians, 3 full time veterinarians. Animals are observed and cared for every day of the year by animal care technicians. Any abnormal health findings are immediately forwarded to a UMMS veterinarian or veterinary technician. In addition to animal housing and husbandry, Animal Medicine provides technical training and educational support for veterinary and surgical services. All UMMS animal facilities are fully accredited by AAALAC (Association for Assessment and Accreditation of Laboratory Animal Care International). The Department of Animal Medicine complies with all pertinent federal and state laws, regulations, and policies regarding the care and use of laboratory animals.

**Cardiovascular & Surgical Models Core** provides University of Massachusetts, outside academic institutions, and pharmaceutical researchers with a central resource for creating and studying cardiovascular physiology, pathophysiology surgical and non-surgical models on a fee-for-service basis. With focus of the core being cardiovascular research, core offers a wide range of techniques for researchers in a variety of other fields. The core can generate surgical models of cardiac, kidney and hind limb ischemia and reperfusion, parabiosis, transverses aortic constriction, carotid artery ligation, and many other surgical models with design and development to support study of rodent models and preclinical research methods.

### The Drosophila Resource Facility provides resources for production of *Drosophila*. Available items include bottles and vials with food, grape and apple juice plates, and larval trays.

The **Umass Metabolic Disease Research Center (MDRC)** at UMass Chan is designed to provide an array of sophisticated research tools for investigating transgenic mouse models of human diseases with particular focus on obesity, diabetes, and its complications. The center comprises five complementary phenotyping cores. The **Metabolism Core** performs non-invasive metabolic experiments to assess insulin sensitivity, glucose/lipid/protein metabolism, body composition, and energy balance in conscious mice. The **Analytical Core** uses a clinical chemistry analyzer and Luminex for high-throughput measurement of serum/tissue hormones, metabolites, and cytokines known to affect metabolism. The **Islet Core** conducts sophisticated *in vivo, ex vivo*, and *in vitro* analysis of insulin secretion, islet function/structure, and pancreatic function. The **Cardiovascular Core** uses imaging to non-invasively assess cardiac and vascular structure and function. The **Humanized Mouse Cell Transplantation and Assessment Core** offers unique “humanized” mice engrafted with functional human cells/tissues to conduct clinically relevant in vivo experiments of human cells, tissues, and immune system.

The **Mutagenesis Core Facility** provides UMass Chan researchers with the latest technologies for targeted genome modification of human cells and various model organisms. The core makes TALEN and CRISPR/Cas9 nuclease constructs, consults with target site selection and mutagenesis design, and helps screen for mutations in cells or animals. The core will work closely with the Transgenic Animal Modeling Core to facilitate production of new rodent models.

### The Transgenic Animal Modeling Core is to produce genetically modified mice, rats, and stem cells for the UMass Chan Scientific Community in a timely and cost-efficient manner. TAMC is composed of two facilities: the Animal Modeling Facility and the Gene Targeting & Stem Cell Facility. The animal modeling facility services include generation of transgenic mice or rats for the research community in a timely and cost-efficient manner; nuclease modification with Zn-finger, Talens or Crisper/Cas9; microinjection of ES cells to generate Chimeric mice; pronuclear DNA injections, lentiviral injections, and nuclease-DNA injections into oocytes to generate transgenic mice and rats; re-derivation of rodents to pathogen-free status; cryopreservation of sperm and embryos; *in vitro* fertilization assistance; orthotopic transplantations of human and mouse cells into immune-compromised mice; and more. The gene Targeting & Stem cells facility can provide generation of ES-cell lines from specific lines of mice; classical and nuclease-driven homologous recombination (HR) gene targeting in mouse ES cells; Nuclease testing of TALENS or CRISORS efficiency in mouse ES cell; induced pluripotency of human and mouse cells (iPS services); tetraploid and blastocyst microinjections of modified ES cells to generate mice and more. Over the past 15 years, the TAMC has engineered more than 500 different mouse or rat models, has generated dozens of genetically altered ES cell or induced pluripotent stem cell lines, and has cryopreserved re-derived more than 450 rodent lines for UMASS researchers and other members of the scientific community.

***Structural Biology***

The **X-ray Crystallography Core** collects and analyzes X-ray diffraction data to determine crystal structures. The Core operates two systems: (i) a Rigaku RU300HR X-ray generator with Osmic optics, a MAR Image Plate System, and an Oxford liquid nitrogen cryogenic crystal cooler; and (ii) a MicroMax-007 HF Microfocus rotating anode X-ray generator with Osmic optics, a Saturn 944 HG CCD detector mounted on an AFC11 4-axis goniometer, and recent upgrade of a CS800 integrated auto-fill nitrogen gas cryostream system for more reliably maintaining protein crystals at cryogenic temperatures during X-ray data collection, and a new state-of-the-art HyPix-6000HE Hybrid Photon Counting (HPC) detector which permits more accurate and higher resolution diffraction data than previous detector.  With these upgrades, the core provides for very rapid, reliable and accurate diffraction data collection.

The **Cryo-Electron Microscopy Facility (Cryo-EM)** provides state-of-the-art, near atomic structural determination. The core hosts three high-end Transmission Electron Microscopes.Titan Krios is a state-of-the-art sophisticated high-voltage (300kV) transmission electron microscope with a superb electronic optical system and a capability to do fast high-throughput data collection. Titan Krios is equipped with the latest Gatan Image Filter (GIF) and Gatan K2 Summit direct electron detector. This combination allows better electron signal to be recorded. This configuration is currently the ideal setup for high-resolution structure visualization, using single-particle electron cryomicroscopy and electron tomography.Talos-Arctica is a 200kV microscope, also equipped with an autoloader to allow fast sample screening and high-resolution data collection. The microscope has a Titan-like objective lens system. Talos-Arctica is equipped with Gatan’s K2 Summit direct electron detector for the best quality image acquisition.Both microscopes are equipped with a Volta Phase Plate to enable visualization of smaller macromolecular complexes. In 2021, the core received $2.8 million from the Massachusetts Life Sciences Center (MLSC) for the purchase of an advanced Talos-Glacios cryo-electron microscope from Thermo Fisher Scientific. The Glacios cryo-electron microscope, Selectris energy filter and Falcon 4 detector dramatically speed workflows in the Cryo-EM Core for both tomography studies and molecular structure determinations using single particle methods. The facility has additional equipment for sample preparation and storage, including two FEI Vitrobot Mark IV, a glow discharge unit, an auto-filled 55-cylinder cryo-grid storage system etc. RTI faculty were instrumental in making this core a reality.

The **Electron Microscopy Facility** is equipped with five electron microscopes—one scanning (FEI Quanta 200 FEG MKII) and four transmission (FEI Tecnai Spirit12, Philips CM10, FEI Tecnai G2T20, and Talos L120C)—and ancillary equipment required to perform all key ultrastructural procedures from the tissue to the molecular level. The facility provides specimen preparation, microscopy, and interpretation of results, but also trains researchers how to use the equipment.

**NMR Spectroscopy** is available through the Department of Biochemistry & Molecular Biotechnology. There are two NMRs: a 400 MHz NMR located in the Lazare Research Building (LRB-845), and a 600 MHz NMR with cold probe in the medical school building (SA-119). Users can have direct access after training.

The **Structure-Based Drug Design** facility provides drug design expertise via molecular modeling, crystallographic studies, molecular simulations, and lead optimization.

***Molecular Analysis***

The **Bioinformatics Core** provides a wide range of computational services to help researchers analyze data generated by various studies. The Bioinformatics Core facility created Foundry (formerly DolphinNext), a software platform to support analyses of high throughput data. Foundry supports the full research cycle by allowing clients to track samples from sample collection to data processing (sequencing, proteomics, metabolomics) and finally to interactive analysis using an intuitive web interface. Foundry is built to ensure secure access to the processed data using 3rd party applications, such as mass quantities of samples on High Performance Computing (HPC) environments, cloud services (AWS, Google Cloud etc.), or personal workstations, for tailor-made analysis and data sharing. It automatically builds Nextflow pipelines by assembling components such as processes and modules, enabling seamless implementation of complex bioinformatics workflows. The core offers assistance for NF-core or customized Nextflow pipelines, allowing easy integration of these pipelines directly from Github or Bitbucket repositories. Foundry platform has been licensed to Via Scientific who maintains, provides support for and further develops the platform and pipelines within. In addition to granting access to Foundry and its routine data analysis pipelines, the core facility provides hands-on training in data analysis and Foundry usage. The core will facilitate the development of new functionality (e.g. new pipelines or modifications) and/or end-to-end data analysis by Via Scientific when needed. Via Foundry's current public pipelines include RNA-Seq Pipelines (RSEM, HISAT, STAR, Salmon, Kallisto, FeatureCounts), ATAC-Seq Pipeline (MACS2), ChIP Seq Pipeline (MACS2), Single Cell Pipelines (10X Genomics, Indrop), piRNA Pipelines (piPipes ChIP-Seq, Degradome/RAGE/CAGE, smallRNA); along with some important sub-modules, Such as Trimmer, Adapter Removal, Quality Filtering, Common RNA Filtering, ESAT, FastQC, MultiQC, RSeQC, Picard, IGV and UCSC genome browser file conversion. all of which are ready to execute in user’s environment.

The **Deep Sequencing Core** employs different Next-Gen sequence technology platforms and other resources to provide analytical services to basic science and clinical investigators, as well as commercial ventures. The DSCL operates one lllumina NovaSeq 6000 (1.6 Billion - 4 billion reads per run), one Illumina MiSeq DX(12 to 25 million reads per run), one Illumina MiSeq (1-25 million reads per run). These genome analyzers are continuously upgraded. The current sequencing platforms support a wide variety of research applications including genomic DNA analysis (gDNA-Seq), small RNA analysis (smRNA-Seq), coupled chromatin or RNA immunoprecipitation-sequence analysis (ChIP- or CLIP-Seq respectively), cDNA/mRNA expression profiling or whole transcriptome analysis (RNA-Seq), 3-, 5-, or Hi-C DNA analysis, coupled DNase I mapping-sequence analysis (DNase-Seq), library or sample book shelving analysis (BSA-Seq), and custom analysis methods. DSCL Illumina-based service operations utilize different read formats and base read lengths (*e.g.* single read (SR) 36, 50, 75, 100, 200, or 300 bases; paired end (PE) 36, 50, 75, 100, 200, 250, or 300 base pairs), as well as different analysis run modes. The DSCL also oversees the service operations of the UMASS CHAN-HHMI **Pacific Biosciences Core Enterprise (PBCE)**, which provides single-molecule, real-time (SMRT™) sequence analyses using the PacBio Sequel II instrument.

The UMass Chan **High Performance Computing (HPC)** Support Team maintains the **Scientific Computing for Innovation Cluster (SCI)**. The SCI cluster is a high-performance computing project funded by the UMass Chan Medical School for use by its Principal Investigators performing computational research. The SCI cluster is primarily intended for batch processing jobs, that is computational work that does not require user interactivity in order to run, but does also support interactive use. IBM Spectrum LSF is the scheduling software used to provide researchers access to cluster resources. All processing nodes are connected via both a 100gbit Ethernet fabric and a Mellanox (now Nvidia) 100gbit HDR100 Infiniband fabric. Storage on the SCI Cluster is provided by a Panasas storage cluster with 3 Director Blades and 16 Storage Blades with 2+ petabytes of storage. All nodes on the SCI cluster run Red Hat Enterprise Linux 8. The cluster consists of qty sixty-two (62) Dell R640 nodes with 40 Intel Xeon Gold 6230 CPU cores @2.10 GHz and 384GB RAM per node, qty twenty (20) Dell C6525 nodes with 128 AMD EPYC 7702 cores @ 3.9 GHz and 512GB RAM per node, qty ten (10) GPU Dell C4140 nodes with 40 Intel Xeon Gold 6230 CPU cores @2.1 GHz and 384GB RAM / four NVIDIA Tesla V100-SXM2-32GB per node, one GPU Dell XE8545 node with 128 AMD EPYC 7763 cores @ 2.4GHz and 512GB RAM/ Four NVIDIA A100-SXM4-40GB per node, total 5,000+ CPU cores, 44+ GPU nodes.

The **Mass Spectrometry Facility** offers state-of-the-art platforms for proteomics, metabolomics, and mass spectrometry imaging. For quantitative proteomics and proteomics, there are three (3) electrospray ionization nano LC-MS/MS systems including a Bruker timsTOF Pro2 instumenet with nanoElute UPLC, a Thermo Scientific Orbitrap Fusion Lumos Tribrid with Waters NanoAcquity UPLC, a Thermo Scientific Q-Exactive (Orbitrap) hybrid instrument configured with a Waters NanoAcquity UPLC. For metabolomics profiling and targeted quantitation, a Thermo Scientific Q Exactive HF-X with Vanquish Flex UHPLC capable of HCD fragmentation and conventional flow is available. A Waters Synapt G2-Si quadrupole time-of flight masspectrometer enabled with ion mobility separation is dedicated to mass spectrometry tissue imaging and intact protein, mAb and oligonucleotide analysis. For targeted metabolomics and small molecules, there are three (3) electrospray ionization LC-MS/MS systems: A Waters Xevo TQ-XS with Acquity UPLC, a Thermo TSQ Quantiva with Dionex Ultimate 3000 UPLC, a Thermo Scientific Orbitrap Velos Pro hybrid instrument with electron transfer dissociation configured with Thermo Accela 1250 UPLC or a Waters NanoAcquity UPLC. The core provides support for study design, sample preparation, sample preparation, data acquisition, informatics, interpretation and publication assistance.

The **Molecular Biology Core Labs (MBCL)** offers discounted DNA, RNA, and specialty oligonucleotides, discounted reagent program, **standard Sanger DNA Sequencing** and genotyping (includes SNP, LOH, AFLP, Microsatellite, ARISA, and Fragment Sizing)**, EconoSEQ (**Economy DNA sequencing), **DNA Fragment Analysis (**profiles and quantifies fragmented or genomic DNA, cDNA, RNA, amplicons, and other nucleic acid derivatives.), BioAnalyzer analysis of RNA and DNA samples, and also offers library construction services for Illumina and PacBio platforms.

The **Integrated Biomarkers Core** provides support to investigators and clinicians in the acquisition and incorporation of multiomics into their research projects to ultimately reveal new insights into inflammatory diseases of multiple organ systems. Give technical and scientific support in a clinical study to run Proximity Extension Assay (PEA) with Olink Platform. Build and optimize novel live tissue culture and imaging assays to validate and advance the mechanistic understanding of disease signaling pathways discovered and characterized through other platforms.

The **Media Prep Core** provides investigators made-to-order microbiological media, plates, and slants for various model organisms. We offer made-to-order buffers and solutions as well. All products are customizable at our end-user’s discretion. Various Model Organisms Include: Yeast, Bacteria, Chlamydomonas, C.elegans and common buffers & solutions.

The **Tissue Culture and Enzyme Freezer Supply (TCEFS)** is UMass Chan Medical School's on-campus source for discounted tissue culture, molecular biology, and microbiology products. The Tissue Culture Center offers a wide range of discounted tissue culture products, buffers, & FBS from major vendors (Thermo Fisher Scientific/GIBCO, Corning, Millipore Sigma) with free shipping, many popular items are on stock for same day deliver & pick up. The Enzyme Freezer program maintains the campus network of self-serve enzyme supply freezers and Kiosks, and free shipping and discount ordering from a serial of vendors (Agilent, Azura Genomics, Bio-Rad, Roche Diagnostics/Kapa Biosystems, Millipore Sigma, National Diagnostics, New England Biolabs (NEB), Promega, Qiagen, Roche, Takara Bio, Thermo Fisher).

***Cell Biology, Imaging, and Histology***

The **Confocal Core-Three Dimensional Microscopy Laboratory (3DML)** provides excellent laser-scanning confocal microscopy equipment, training, and technical support to the UMass Chan Medical School research community. The core provides training on and is equipped with Leica TCS SP5 II laser-scanning confocal microscope with AOBS (Acousto-Optical Beam Splitter), spectrophotometric detection, and a 405-nm laser. Three dimensional imaging with optical sectioning is achieved using 8 laser lines, at 405, 458, 476, 488, 496, 514, 561, and 633 nm. Advanced spectrophotometric detection uses 5 detectors: 3PMT’s (photomultiplier tubes), and 2 HyD’s (Hybrid detectors) that provide superior sensitivity, a large dynamic range, high-speed imaging capabilities, single photon counting options, improved cell viability.

The **Flow Cytometry Core Lab** provides a wide variety of cytometry services for internal and external investigators with state-of-the-art sorting and analyzing capabilities. Flow cytometry allows the simultaneous measurement of relative cell size, internal cellular complexity, relative fluorescence intensity, multiple color and parameter analysis and imaging. The core has the following analyzers available for core-run analysis or self-use: three (3) Cytek Aurora spectral analyzers (with 5 lasers, 2 have HTS); two (2) BioRad ZE5 analyzers (5 laser); a BD Symphony (5 lasers); a BD Celesta with HTS (3 lasers), a MACSQQuant VYB (3 lasers); and a Amnis FlowSight imaging cytometer. The following sorters available in biosafety cabinets for core-run or self-use: a BD FACSAria Fusion (5-laser); two (2) FACSAria II/IIu with various capabilities (4 or 5 lasers); a Sony MA900 4 laser (for self-use); a BD FACSMelody 3 laser (for self-use). Sorters are available for BSL-2 through BSL-3 conditions. Also available are the Miltenyi AUTOMACS magnetic bead cell separator and the Fluidigm C1 single-cell IFC system. All instruments other than the BSL-3 sorter are available for investigator self-use after training is completed.

The **Image Processing and Analysis Core** provides image processing and analysis service to help scientists and clinicians develop imaging biomarkers using different imaging modalities with the goal of: Detecting and diagnosing diseases to enable an early stage to enable early treatment intervention. Tracking disease progression/tissue regeneration allowing clinicians to evaluate the medical condition. Monitoring treatment effects either via conduits for drug delivery and regenerative medicine applications or via other interventional procedures to facilitate therapeutic mechanisms.

The **Morphology Core Facility** provides histology services, including routine histological preparations, special stains, immunohistochemistry, and frozen sections. The core provides advice on techniques that are appropriate for submitting and evaluating morphologic preparations.

The **Optical Animal Imaging Facility** located in the Animal Facility A-level uses the Perkin-Elmer IVIS systems. The IVIS-100 and IVIS Spectrum CT imaging systems allow detection of bioluminescence and fluorescence contained within solutions, petri dishes, culture plates, cells or live animals*.* Each camera is equipped with a gaseous anesthesia vaporizer. Oxygen and isoflurane are provided. There is also a new Vevo 3100 High Resolution Ultrasound System (VisualSonics) for small animal models. The systems can be used for longitudinal studies involving tumor development and metastasis, treatment response, and the assessment of other pathological states, such as host infection by pathogens.

The **Sanderson Center for Optical Experimentation (SCOPE)** is a UMass Chan Medical School light microscopy core facility, offers the tools and expertise required to perform a wide variety of quantitative microscopy techniques including super resolution imaging, multi-photon intravital and live tissue imaging, confocal microscopy, and high-speed time-lapse imaging. The SCOPE offers a combination of commercial and custom-built microscopes, allowing users to address an extensive array of biological questions. The center operates the following instruments (located in S5-213): five confocal microscopes including a Leica STELLARIS 8 with white light laser, a Leica SP8, Leica MICA Widefocal, a Nikon A1 confocal  and a TissueGnostics TissueFAXS SL Q; three super resolution and TIRF microscopes including a Leica STELLARIS 8 STED (3 STED lines), a Bliq Photonics Multiphoton with SLaM, and a Olympus 4line cellTIRF; two multiPhoton microscopes with an Upright Bliq Photonics Video Rate Multiphoton with inSight DeepSee laser and an Inverted Bliq Photonics Video Rate Multiphoton with inSight DeepSee laser; in addition there are six live cell imaging systems, six widefield microscopes, and three spatial biology instruments (Nanostring GeoMx DSP and Vizgen Mercope and Merfish Alpha) and two slide scanning microscopes.

***Screening***

The **RNAi Core Facility** houses complete collections of human and mouse retroviral and lentiviral short hairpin RNA (shRNA) libraries from Open Biosystems/GE, the Mammalian Gene Collection (MGC) cDNA Library, and the human and mouse CRISPR/Cas9 GeCKO v2 libraries from Addgene. The MGC cDNA Library contains a total of 16,953 human (6609 clones; 5537 unique sequences) and mouse (10,344 clones; 7718 unique sequences) sequence-validated full-length cDNA sequences in an expression vector (pCMV-Sport6). The GeCKO v2 libraries consist of over 100,000 unique guide RNAs for gene knock-out in either the human or mouse genome. Libraries are available for distribution to UMass researchers at a reduced price in individual or pooled clones or DNA plasmid prep or viral supernatant.

The **Small Molecule Screening Facility (SMSF)** assists researchers in developing high-throughput (HT) screening assays, performs HT screens of chemical libraries to identify new small molecules that can be used to probe biological processes of interest. SMFS has 30,000 drug-like small molecules from Chembridges's DIVERset library. The set is rationally selected based on 3D pharmacophore analysis to cover the broad part of the biologically relevant pharmacophore diversity space. The core also owns a library from MicroSource: FDA-approved US drug collection (1040 compounds) and an international drug collection (240 compounds). The SMSF offers researcher the ability to screen the LOPAC 1280 pharmacologically active compounds. This annotated collection of small molecule modulators and approved drugs impacts most cellular processes and covers all major drug target classes. The Cheminformatics database allows researchers to rapidly evaluate and compare results of their screens and can also be used in the future to classify the function of lead structures and biological targets. The coreprovides two Biomek FxP (Beckman Coulter) automated, multitasking liquid handler with cherry picking capabilities, a BioTek Mutiflo FC fluid dispenser for multi-well plates up to 1536 wells. For plate reading, the core has a EnVision (PerkinElmer) and a Tecan Safire plate reader with detection for fluorescence, luminescence, absorbance, time-resolved fluorescence, fluorescence polarization, Alpha screen and real time kinetics. The EnVision includes injectors, permitting automated cell lysis with sequential dual-luciferase detection. The core also has a Molecular Devices ImageXpress High Content Analysis System which can handle up to 45 plates for high throughput data acquisition. An Agilent 6130 Series Single Quadrupole LC/MS with Auto sample for simple injection from vials, 96 and 384 well plates is also available to use. There is also a Biacore 8K SPR for interaction analysis allowing ranking, kinetics, affinity, epitope binning, concentration, and relative potency. It can screen 2,300 molecules in a day.

***Clinical and Pre-Clinical Studies***

The **UMCCTS Biospecimen, Tissue, and Tumor Bank (Biorepository)** is an open access biorepository that supports investigators in patient-oriented research. Specifically, the Biospecimen and Tissue Bank provides services that help UMass and external investigators to obtain, store, and study high quality human research-related specimens, while maintaining patient confidentiality. It houses both a collection of fixed, paraffin embedded tissue and samples which were collected fresh and frozen/processed immediately following surgery. When possible, surrounding healthy tissue samples are also processed and stored. Along with the storage and processing of samples, the Biorepository serves as a dynamic collection and distribution service. Researchers can request fresh tissue and have specific study needs met. It also provides regulatory guidance, including protection of human subjects, tissue ownership, limitations on how tissues may be used and responsibilities to UMass, and on long term storage and inventory management using OpenSpecimen. Assistance in the IRB approval process is offered, and consultation during study design is recommended.

The **AAV Large Scale Manufacturing Facility** is a large-scale manufacturing facility at the UMass Chan, located in the Horae Gene Therapy Center. It is 3220 square feet in size and features GLP viral vector FlexFactory™ manufacturing platforms, which integrate many of Cytiva’s systems for AAV production. Six professional staff manage the day-to-day operation of the facility, which is now fully operational. The services include: AAV capsid DNA engineering for insect cell production; process and development for large scale AAC manufacturing; Medium scale AAV manufacturing with 10L XDR10 or 25L wave bioreactors; large scale AAV manufacturing with 2x 200L XDR2000 bioreactors; analytical and QC lab. The production scale ranges from investigational gene therapy studies that require small-scale GLP AAV production to translational gene therapy research that requires large-scale GLP AAV production. These scales can be further developed into the GMP AAV production scale that is required for clinical and commercial gene therapy through the Mass Biologics-UMass Chan partnership.

The **Advanced MRI Center** is equipped with a Philip’s Ingenia CX dStream 3.0T system and a Bruker BioSpec 70/30 (i.e., 7T, 30 cm bore) USR horizontal bore MR system.  The center provides the latest magnetic resonance imaging and spectroscopy capabilities to scientists and clinicians for human and animal studies. Specific areas of research include, but are not limited to, fMRI, cardiac MRI, interventional MRI, and Hyperpolarized Gas MRI.

The **Bone Analysis Core** provides bone imaging services, bone histology and histomorphometry services. The facility has a Scanco microCT35 capable of high-resolution micro-computed tomography. It can scan ex vivo rodent bone samples that are up to 36 mm in diameter and 80 mm in length at resolutions down to 8 µm. A Siemens Inveon Research Workplace 4.0 software can provide state-of-the-art 3D-reconstruction images of the microstructure of specimens. There is also a Trident™ specimen radiography system includes micro-focused x-ray tube, specimen image processing algorithms and selenium-based detector technology that provides the excellent image quality. Under the histology portion of the core, available services include sectioning and basic staining of rodent bones and static & dynamic histomorphometry.

The **Clinical Research Center (CRC)** is dedicated to efficient, reliable, and high-quality study support for UMass Chan clinical investigators. The CRC has provisions for dedicated study space, including twelve exam rooms with exam tables or comfortable recliners for lengthy visits, touchdown space with clinical computers for for visiting researchers and staff, and in-unit BSL-2 laboratory equipped with centrifuge, hematocrit machine, –20°C and –80°C freezer space, and prep area for packaging and shipping of study specimens daily FedEx pickup. The CRC also provides regulatory support for IRB submissions, assistance with external regulatory communications, and assistance with posting to http://www.clinicaltrials.gov.

The **Leukocyte Core** endeavors to provide campus investigators with a relatively convenient, cost-effective, and reliable source of valuable viable human peripheral blood leukocytes as an important resource for biomedical research, including research in the fields of immunology, inflammation, and infectious diseases. The core facility provides leukoreduction filters that have been used to remove leukocytes from whole units of blood obtained from normal blood donors. UMass investigators can then extract the leukocytes from the leukoreduction filters for downstream applications such as the isolation of peripheral blood mononuclear cells on density gradients of ficoll, percoll, or equivalent.

**The New England Center for Stroke Research** (**NECSTR)** is a neuroradiology facility that offers the latest technology in image-guided intervention to support UMass Chan investigators in developing minimally invasive treatments. The center’s expertise and resources enable animal modeling of vascular pathologies, 3D x-ray imaging, post-acquisition image processing, rapid prototyping from medical imaging and image guided minimally invasive surgery. The center houses the latest flat-panel-detector x-ray system (Allura FD20, Phillips Medical Systems, Best, Netherlands). The system offers both cardiac and vascular packages, 3-dimensional reconstruction angiography (3DRA), X-per™ cone-beam computed tomography, and various software prototypes not yet available for clinical use. The suite is fully equipped for aseptic surgical procedures, including medical gases, physiologic monitoring, scrub room, OR lights, surgical camera, and AV equipment for procedure documentation. Adjacent to the angiosurgical suite is the animal prep/recovery room. The center also incorporates a chemistry and hemodynamics laboratories for bench-top, *in vitro* studies.

**Radio Labeling & Small Animal Translational Imaging Core** **(RLASTIC)** serves the UMass Chan and extramural research community by providing state-of-the-art small animal imaging. Single-photon computerized tomography (SPECT), positron-emission computerized tomography (PET), X-Ray computerized tomography (CT), and NIR optical imaging of small animals are available. The core is equipped with Milabs VECTor6 CT for combined PET/SPECT with ultra-high resolution CT, Bioscan NanoSPECT/CT camera for CT imaging and imaging single photon emitters (SPECT), the Philips Medical System Mosaic microPET for imaging positron emitters (PET), Li-Cor Pearl Imager for near-infrared fluorescence, and **IVIS 100** capable of both bioluminescence and fluorescence. Images from those systems may be sent to any user by DICOM or through the web by iPACS software.

The **Research Methods Collaborative** in the Department of Quantitative Health Sciences was founded to provide a wide range of services and expertise to researchers throughout all phases of their studies. From initial study design and the development of funding proposals to study implementation and data collection, and through the final stages of data analysis and reporting, researchers have access to faculty and staff with the expertise to assist them throughout their studies. The collaborative composes four cores: Qualitative Research Core (QRC), Quantitative Methods Core (QMC), Research Informatics Core (RIC), and Measurement, Outcome, & Design Section (MODS).

The **Qualitative Research Core (QRC)** assists UMass Chan and affiliate investigators with the design, implementation, and analysis of qualitative research, and in preparing qualitative grant submissions and manuscripts. The QRC also help foster an interest in qualitative research among UMass Chan and affiliate investigators through timely qualitative methods seminars, and to develop qualitative research methods courses, including courses focused on ethnography and general qualitative research methodology.

The **Quantitative Methods Core (QMC)** in close collaboration with the UMass Chan Center for Clinical and Translational Science (CCTS) provides UMass Chan investigators with clinical research support in biostatistics, experimental design, and data management. **The core** helps researchersdesign studies, including general medical studies, clinical trials (Phase I-IV), preclinical, quasi-experimental designs, retrospective/prospective studies, and group-randomized designs; provide sample size and power calculations; collect and manage data; advise on resources available for conducting Health Services and Health Outcomes Research, such as claims data (Medicaid, Medicare) and large survey databases (NHANES, BRFSS); and help analyze the study.

The Research **Informatics** **core (RIC)** team has collaborated with internal researchers in various projects, including creating retrospective studies data pipelines, customized data extraction for patient recruitment, and developing real-time patient recruitment applications and standardized data warehouses to support self-service tools to assess the feasibility of patient cohort definition. It maintains the UMCCT Data Lake, a large repository of data from heterogeneous clinical systems with millions of patients, and provide services as complaint access to data, data innovation research, and spearhead data collaborations. The RIC also provides self-service tools to evaluate study feasibility and identify appropriate cohorts for the recruitment of clinical trials. The following tools provide de-identified aggregated counts of patients with the clinical characteristics of interest for a clinical trial: TiNetX, i2b2 Informatics for Integrating Biology & the Bedside, Accrual to Clinical Trials (ACT) Network, The National COVID Cohort Collaborative - N3C, Conquering Diseases registry.

The **Measurement, Outcome, & Design Section (MODS)** focuses on professional assessment, refinement, and development of Measures and Outcomes, and the novel study Design in quantitative health sciences.

The **Investigational Drug Service (IDS)** pharmacists play a key role in facilitating subject safety for clinical trials being conducted at UMass Chan Medical School (UMass Chan) and UMass Memorial Medical Center (UMMMC). The IDS has the following major roles and responsibilities: Consultation with investigators pre-study and throughout conduct of trial, including assessment of appropriate charges for investigational services; Preparation of IDDF (drug data form); Aiding in procurement of investigational drugs; Receipt, storage, accountability, dispensing and return/destruction of all investigational drugs; Monitoring of all ongoing investigational drug activity by clinical researchers in the UMass Chan or on the campuses of UMMC; Control and accountability of investigational drugs according to state and federal regulatory requirements, sponsor specifications and hospital pharmacy practice. With limited exception, UMass Chan/UMMMC policy requires that all drugs used for investigational purposes at UMass Chan/UMMMC must be stored, compounded, and dispensed in the Investigational Drug Service pharmacy.  Exceptions can only be made with advance approval by Investigational Pharmacy.

The mission of the **Skin Diseases Research Core** is to establish an efficient way to conduct preclinical mouse studies and translational research services to investigate skin diseases for UMass Chan faculty as well as investigators from external sources. Preclinical studies will include testing novel treatments in mouse models of skin disease for efficacy and mechanism of action, as well as exploring functional contributions of cells or proteins in the pathogenesis of skin diseases. Existing mouse models include vitiligo (developed by Dr. John Harris), psoriasis (imiquimod-induced).  Translational studies will include recruiting subjects with skin diseases and sampling their skin and blood for analysis of cells and proteins. To date we have recruited vitiligo, psoriasis, and lupus patients for translational studies, and have shared samples with collaborators at UMass Chan as well as externally.

The **Umbilical Cord Blood Core** operates out of the Labor and Delivery unit on the UMMHC- Memorial Campus. With patient verbal consent, umbilical cord blood units are collected real time, following delivery of the neonate by either cesarean or vaginal delivery. Every year, approximately 4,000 deliveries are performed at UMMHC.  When approached in labor, ~80% of women with an epidural consent to donation, and a greater proportion of women are amenable to donation when it is discussed in the prenatal period. Collected units are refrigerated without patient identifiers or clinical information except for what is needed for confirmation of adherence to IRB-approved eligibility. On average, collected units weigh 132.6 grams (±33.2), with a range of 65 grams to 251 grams, and are collected in standard bags that are provided through the core and contain a Citrate Phosphate Dextrose anticoagulant solution. The core may be able to assist labs desiring umbilical cord blood units collected as per specific protocols that differ from our current, and/or that are paired with clinical data or other information not already collected; however, it may require a different IRB and consent processes.

The **Viral Vector Core (VVC)**, housed in the Gene Therapy Center, uses cutting-edge technologies to create and produce a variety of high-quality viral vectors. The goal of the VVC is to provide investigators at UMass Chan with the most suitable and efficient gene-transfer vectors for their research applications. Services include consultation in selection, design, and application of gene-transfer vectors, adenovirus (Ad) vector creation and production, adeno-associated virus (AAV)-vector production, lenti/retrovirus-vector production, and AAV neutralizing antibody screening and titration. VVC produces more than 900 rAAV vector batches a year, supporting UMass Chan investigators as well as external needs from academia and industry around the world. VVC is in the preliminary planning stage for a human applications GMP facility to produce clinical grade viral vectors.

The **BSL-3 Core Lab** is a self-contained laboratory with space and equipment to handle hazardous pathogens that require BL3 containment, as defined in the CDC/NIH publication “Biosafety in Microbiological and Biomedical Laboratories”. The lab was specifically approved by the USDA and CDCfor research of airborne viruses, such as the Hong Kong chicken flu, and other select agents. The laboratory has a dedicated ventilation system that maintains a negative pressure with respect to the adjacent corridor and rooms and provides HEPA filtration of exhaust air at a remote location on the roof.

**Links for cores: (for more information, not for inclusion with grant proposals)**

***Animal Models***

**Animal Medicine**

<https://umassmed.sharepoint.com/sites/animal-medicine>

**Cardiovascular & Surgical Models Core**

### <https://www.umassmed.edu/research/cores/csrc/>

**Drosophila Resource Facility**

<https://www.umassmed.edu/research/cores/drosophila-resource-facility/>

**Mouse Metabolic Phenotyping Center**

<http://www.umassmed.edu/umpc/>

**Mutagenesis Core Facility**

<http://www.umassmed.edu/research/cores/mutagenesis/>

### Transgenic Animal Modeling Core

<http://www.umassmed.edu/tkomouse/>

***Structural Biology***

**X-ray Crystallography Core**

<https://www.umassmed.edu/research/cores/crystallography/>

**Cryo - Electron Microscopy Facility**

<https://www.umassmed.edu/research/cores/cryo-em-core-facility/>

**Electron Microscopy Core Facility**

<https://www.umassmed.edu/cemf/>

**NMR Spectroscopy**

<https://www.umassmed.edu/bmp/facilities/overview/>

**Structure-based Drug Design**

<https://www.umassmed.edu/research/cores/structured-base-drug-design/>

***Molecular Analysis***

**Bioinformatics Core**

<http://www.umassmed.edu/biocore/>

**Deep Sequencing Core**

<http://www.umassmed.edu/nemo/>

**High Performance Computing (HPC) Scientific Computing for Innovation Cluster (SCI)**

<http://www.umassmed.edu/it/services/research-computing/high-performance-computing/>

**Mass Spectrometry Facility**

<https://www.umassmed.edu/MSF/>

**Molecular Biology Core Labs (MBCL)**

<https://www.umassmed.edu/nemo/mbcl/>

**Integrated Biomarkers Core**

<https://www.umassmed.edu/ccts/research-resources/core-resources/biomarkers-core/>

**Media Prep Core**

<https://www.umassmed.edu/research/cores/mediaprep/>

**Tissue Culture and Enzyme Freezer Supply (TCEFS)**

<http://www.umassmed.edu/tcefs/>

***Cell Biology, Imaging, and Histology***

**Confocal Core - Three Dimensional Microscopy Laboratory**

<http://www.umassmed.edu/3dml/>

**Flow Cytometry Core Lab**

<http://www.umassmed.edu/facslab/>

**Image Processing and Analysis Core**

<https://www.umassmed.edu/research/cores/ipac/>

**Morphology Core Facility**

<http://www.umassmed.edu/morphology/>

**Optical Animal Imaging Facility**

<https://www.umassmed.edu/research/cores/optical-imaging/>

**Sanderson Center for Optical Experimentation (SCOPE)**

<https://www.umassmed.edu/scope/>

***Screening***

**RNAi Core Facility**

<http://www.umassmed.edu/shrna/>

**Small Molecule Screening Facility (SMSF)**

<http://www.umassmed.edu/smsf/>

***Clinical and Pre-Clinical Studies***

###### **The UMCCTS Biospecimen, Tissue, and Tumor Bank (Biorepository)**

<https://www.umassmed.edu/tissue-and-tumor-bank/>

**AAV Large Scale Manufacturing Facility**

<https://www.umassmed.edu/research/cores/raavmanufacturing/>

**Advanced MRI Center**

<http://www.umassmed.edu/advmri/>

## Bone Analysis Core

<https://www.umassmed.edu/research/cores/bonecore/>

**Clinical Research Center**

<https://www.umassmed.edu/ccts/research-resources/ocr/clinical-research-center/>

**Leukocyte Core**

<https://www.umassmed.edu/research/cores/leukocytecore/>

**New England Center for Stroke Research**

<http://www.umassmed.edu/necstr/>

**Radio Labeling & Small Animal Translational Imaging Core (RLASTIC)**

<http://www.umassmed.edu/saicf/>

**Research Methods Collaborative**

<https://www.umassmed.edu/pqhs/qmc/>

**Investigational Drug Service (IDS)**

<https://www.umassmed.edu/ccts/research-resources/ocr/pharmacy-services/>

### Skin Diseases Research Core

<https://www.umassmed.edu/research/cores/sdrc/>

**Umbilical Cord Blood Core**

<https://www.umassmed.edu/research/cores/cord-blood/>

**Viral Vector Core (VVC)**

<https://www.umassmed.edu/gtc/viral-vectors/viral-vector-core/>

**BSL-3 Core Lab**

Please contact school EH&S for training and access.

<https://umassmed.sharepoint.com/sites/ehs-intranet/SitePages/Biosafety-Training.aspx>