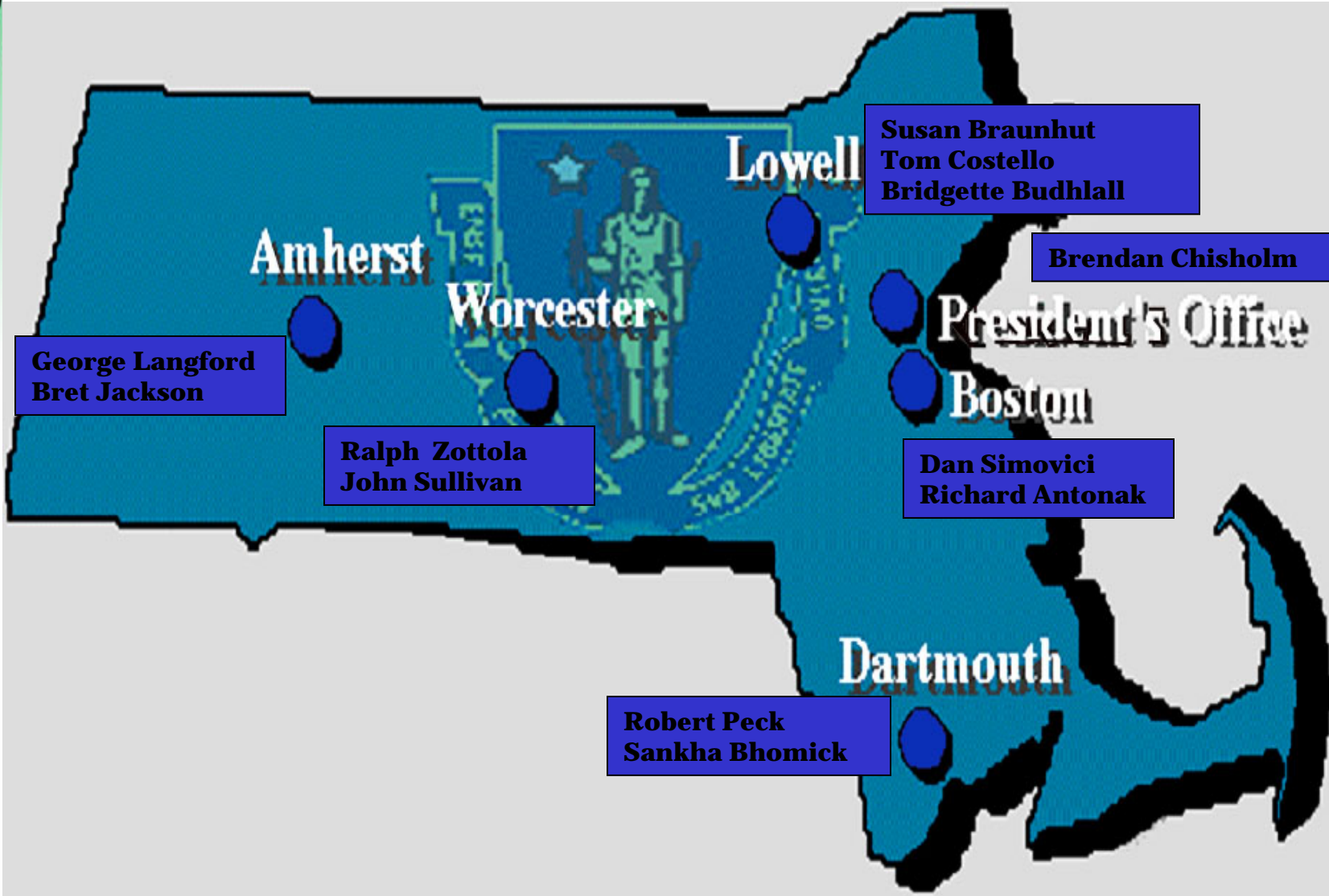


Shared Infrastructure & Additional R & D Working Group

Working Group Members:



MASS Stem Cell
Initiative

- hESC Bank
- hESC Registry

Bioinformatics Cores

Tissue Engineering

Diagnostics

Biomaterials

Computational
Sciences

Stem Cell Initiative

Primary objective: U Mass will create a stem cell bank and registry to archive and distribute non-NIH approved lines of embryonic stem cells from human and murine sources. The lines will be made available to investigators around the world to support basic and applied research on stem cell development and differentiation and the registry will be available to centralize information on these and future distinct lines in a format that will provide a searchable database to the scientific community.

Role of lead and adjunct campuses: U Mass Worcester will lead the human embryonic stem cell effort and U Mass Amherst will lead the murine embryonic stem cell effort. U Mass Dartmouth has a GMP facility that could be leveraged in this effort and there are funded regenerative medicine projects at U Mass Lowell and Boston that would utilize these resources.

Facilities: Core facilities exist in animal medicine, flow cytometry, siRNA, microscopy imaging, deep sequencing, genomics and cell culturing to support these efforts at UMass Amherst and Worcester. However, in general, core facility usage should be competitively priced for U Mass researchers outside the host institution. Rehabilitation of the Worcester Foundation for Experimental Biology site at 222 Maple Avenue, Shrewsbury, MA is planned to house the embryonic stem cell facilities.

Sustainability: The bank and registry will provide an invaluable resource to the region and the nation. This specific activity does not have a planned revenue recovery and will required support from the state. Currently stem cells are provided to investigators free of charge at UMMC. In contrast, NIH does have a fee structure for shipping, handling and quality control of lines provided to the scientific community.

Future infrastructure needs: This initiative will require facilities, staffing, an internet 2.0 environment and high performance computing capabilities throughout the system.

Integration within the U Mass system: This resource will be of value to investigators on all the campuses and will likely stimulate ongoing and additional research in the areas of regenerative medicine, stem cell biology and tissue engineering.

MASS Stem Cell Initiative

- hESC Bank
- hESC Registry

Bioinformatics Cores

Tissue Engineering

Diagnostics

Biomaterials

Computational Sciences

Bioinformatics and Computational Sciences

Primary objective: Informatics are necessary to the Life Sciences Initiative and are required to support activities in medical modeling, imaging, cheminformatics, proteomics, metabolomics, genomics, artificial intelligence, systems biology and management of large clinical databases. The conduct of science today in all life science disciplines requires investigators to be able to access, analyze, mine and transfer large data sets.

Role of lead and adjunct campuses: U Mass Lowell, Worcester and Amherst have facilities and existing academic and research programs and faculty to support and encourage life sciences initiatives in informatics and computational sciences. U Mass Boston and Dartmouth also have faculty and emerging strengths in these areas. The U Mass Boston Venture Development Center could support contact with the user community and training opportunities.

Facilities: System-wide, enhancement of IT infrastructure beyond desktop computing and basic networks is needed. Campus networks are established with high quality data centers at several locations, instrumentation is generally good across the system and there is access to super-computing at USCD, U Pitt and national labs from some campuses.

Sustainability: There are strategies that could sustain support for core facilities in HPC once the initial investment is made. A staff person could create a business model for subsequent acquisition of state, federal and philanthropic support.

Future infrastructure needs: A high performance computing core service offered centrally to the entire system is needed. This would consist of HPC systems, massive data storage, visualization systems, advanced instrumentation linked by high speed and high capacity network. Critical missing pieces are Peopleware to work with researchers to parallelize programming, technicians to maintain and design security for these systems, massive and secure data storage, shared special purpose instrumentation and a communications network.

Integration within the U Mass system: Software, hardware and centralized coordinated planning are needed to provide a system-wide footprint to integrate and maximize capacity of the university computing functions.

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Tissue engineering and biomaterials

Primary objective: The innovative design, manufacturing and characterization of novel biomaterials for biomedical applications and in basic life sciences research are major strengths within the U Mass system. Biocompatible materials can be used to replace, restore, or augment biological materials in biomedical applications; they may be used to create biosensors and create nanomachines, novel textiles, devices and instrumentation.

Role of lead and adjunct campuses: U Mass Lowell and Amherst have extensive active and diverse faculty, academic and funded research programs in the areas of developing, testing and applied biomaterials, high performance polymers, nano and bio-devices, complex fluidics, MEMS & microsystems. U Mass Dartmouth has ongoing activities in the textile and materials areas and a GMP facility and U Mass Boston has faculty with interest and emerging strengths in these areas. There is a integrated biomedical engineering Ph.D. program with course offerings, faculty and quality graduate students in the program from U Mass Lowell, Dartmouth, Boston and Worcester.

Facilities: U Mass Lowell and Amherst have individual centers that focus on one or more of these areas of research but these facilities are not centralized. U Mass Lowell recently created a well equipped and fully-staffed shared materials characterization laboratory with a fee structure for U Mass vs. outside users.

Sustainability: Federal and non-federal grant funding, patents, licensing and commercialization of IP will support continued work in these areas.

Future infrastructure needs: There is a significant reliance on state-of-the-art equipment and technical support for these types of research efforts. Yet the purchase, maintenance and operation of such equipment typically places equipment outside of the reach of individual groups. Therefore, we urgently need a campus-wide facility that would provide groups involved in the biomaterials research with access to the state-of-the-art instrumentation. A list of needed equipment in such a facility is available. All campuses cited the need for clean rooms. To participate to a greater degree, U Mass Dartmouth would need a animal facility.

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Diagnosics and Medical Devices

Primary objective: The Life Science initiative will support increased activity in the areas of medical diagnostics, imaging, biosensors, and development of improved markers and prognostic indicators of human health and disease.

Role of lead and adjunct campuses: U Mass Worcester, Lowell and Amherst lead in the area of diagnostics and medical devices. U Mass Boston has been a leader in enhanced imaging and in the study of health disparities and the Dartmouth campus in the detection of blood borne toxins from infectious agents. U Mass Lowell and Worcester have partnered to create the Medical Device Development Center and the New Nanomedicine Institute represents collaboration between U Mass investigators in the areas of antimicrobial surfaces, nanoparticles to enhance immune function in fighting disease and portable devices for medical diagnosis.

Facilities: Each campus has some shared or core facilities to support the research areas that are a focus on that campus, but these are not centralized and the fee structure for outside the host institution is not competitive. Core facilities are available in small molecule characterization, proteomics, genomics, deep sequencing, morphology, biomaterials, etc.

Sustainability: Additional core facilities could be supported by a fee for service structure.

Future infrastructure needs: Whole animal *in vivo* imaging is available through WPI, but this would be used by many investigators if this was available within the U Mass system.

Integration within U Mass system: A project is underway at U Mass Worcester to create a Bio-repository and invite the community to participate in clinical translational research by providing bio-samples for research and/or subscribing to a clinical trials contact database. These types of activities should be supported and expanded.

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- In conclusion, each campus has developed individual strengths in the life sciences.
- These activities and initiatives could be strengthened by:
 - Hosting the stem cell bank and registry.
 - Creating pivotal state-of-the-art cores in biosample, biomaterial and medical device development and characterization.
 - Instituting a system-wide improvement in computing capacity and connectivity that would support assembly, access to and analysis of large data sets.

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