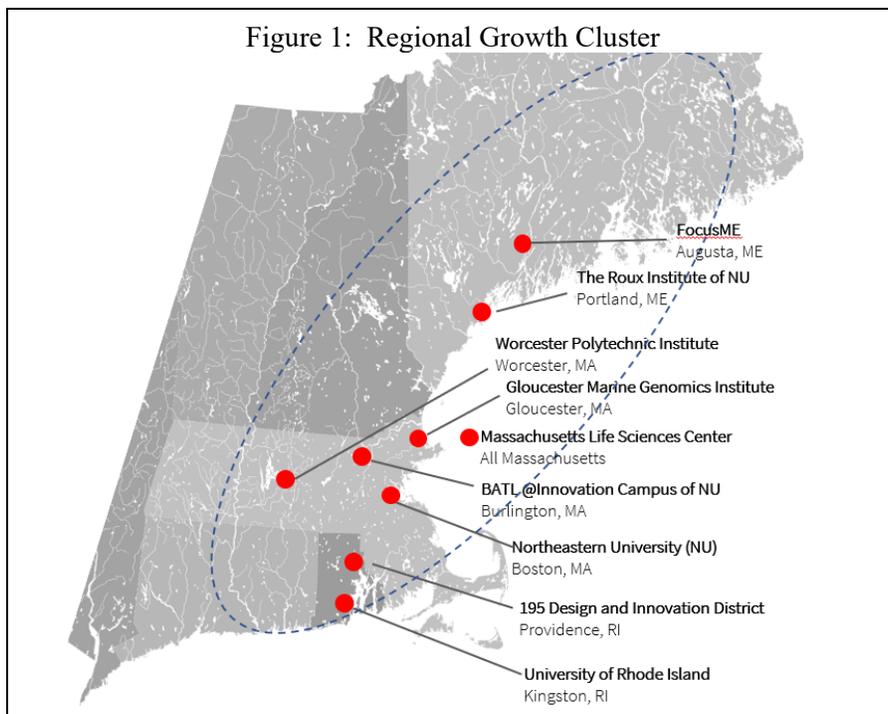


**(1) Overall Concept and Anticipated Outcomes:** *BioConnects New England* is a cluster-based economic development approach to create leadership in biomanufacturing that is accessible to communities and individuals that have been excluded from one of the fastest-growing industries in New England with national strategic importance. Maintaining the United States' global leadership in the life sciences depends on the appropriate infrastructure and a trained workforce that can continue to support innovation, entrepreneurship, and – critically – domestic manufacturing of biopharmaceuticals (biomanufacturing). The purpose of our proposed coalition is to connect hubs throughout New England to support existing and establish new biomanufacturing infrastructure as a pathway to the good jobs of tomorrow for underserved regions, which will be built as much on short-term, targeted retraining programs at the community college level as on advanced STEM degrees. By supporting biomanufacturing infrastructure together with workforce development efforts, the coalition will provide an on-ramp into the biotechnology sector for individuals without a four-year college degree who can secure a stable, high-quality biomanufacturing job often with a starting salary, according to Glassdoor, of \$40k-\$69K (average \$52K). The coalition will also support the individual through the learning continuum if they wish to pursue associate, bachelor, or other advanced degrees.

Northeastern University will lead a multi-state coalition across Maine, Massachusetts, and Rhode Island, including the Biopharmaceutical Analysis Training Laboratory at Northeastern University (BATL, Burlington, MA), The Roux Institute at Northeastern University (Portland, ME), Massachusetts Life Sciences Center (MLSC), Gloucester Marine Genomics Institute (GMGI, Gloucester, MA), Worcester Polytechnic Institute (WPI, Worcester, MA), the I-195 Design & Innovation District in Providence, RI and the University of Rhode Island (FIGURE 1).

This coalition will support biomanufacturing of monoclonal antibodies and other emerging areas such as cell/gene therapies and RNA/DNA therapeutics. With Cambridge, Massachusetts being one of the largest hubs for biotechnology research and discovery, co-locating biomanufacturing in areas adjacent to that research hub throughout New England will accelerate innovation and support economic growth in the region. As an example, Moderna produced its COVID-19 vaccine in Norwood, MA

which helped ensure its successful manufacture. Similar to Moderna, emerging technologies and therapies targeted by our coalition require tighter supply chains and closer collaboration between



R&D and manufacturing personnel than traditional pharmaceuticals where manufacturing can easily be outsourced or offshored. The proposed scale up/prototyping facilities will help accelerate the development of these technologies.

### **Component Projects.**

- *Project 1: Workforce Training and Education Pipelines for Demand-driven Industry Needs.* This project will address a critical need for training talent for laboratory and manufacturing operations, in particular in the emerging fields of cell/gene therapies, DNA/RNA technologies, regulatory and quality support, and business support services. New talent will be identified by reaching out to local communities, offering workshops that expose students, with an emphasis on students of color, to Biotechnology and advise and guide students towards pursuing careers in biomanufacturing. A continuum of opportunities—from certificates, apprenticeships and associate degree programs through bachelor's and other advanced degrees—will be offered to fill the current gap in developing a trained biomanufacturing workforce leveraging a shared curriculum developed here.
- *Project 2: Scale-up and Prototyping for Advanced Biopharmaceutical Manufacturing.* This project will serve as a critical enabler for biomanufacturing of emerging technologies to address an existing shortage in scaling capabilities and to allow companies to prototype prior to full-scale production. The scale-up and prototyping facilities (e.g., Roux Institute, BATL, WPI, RI) will include infrastructure to support commercial scale bioreactors where companies can develop and test the processes and procedures for full commercial scale production. In these same facilities, novel hardware and software prototypes (e.g., sensors) can be tested and iterated on to improve the biomanufacturing process.
- *Project 3: Laboratory Incubator and Accelerator.* Scale-up and prototyping laboratories (e.g., Roux Institute, BATL, RI) will be built to support network-wide activities in workforce training [Project 1], to ensure a robust pipeline of scalable businesses and technologies that can advance to small-scale manufacturing [Project 2], and to accelerate translational research, early demonstration, and commercialization programming. The home of BATL on the Innovation Campus in Burlington, MA and TechStars at the Roux Institute provides a foundation of expertise in acting as an incubator and accelerator for early-stage biopharma companies and will be expanded in this project. Activities in this element are expected to address a shortage of laboratory infrastructure in the hubs in Maine, MetroWest (Massachusetts), and throughout Rhode Island. In addition, the coalition will help identify and support minority and woman entrepreneurs and minority- and woman-owned early-stage companies in our incubator and accelerators spaces leveraging expertise from programs such as Supply RI (Appendix 2i).
- *Project 4: Building for Equity.* In Project 1 the coalition will support the development and training of a diverse workforce and in Projects 2 and 3 the coalition will support minority and woman entrepreneurs of early-stage companies. In this project the coalition will develop wrap-around services to help support minorities and woman across project activities. This may include mentoring, childcare services, and purchase of learning materials and laptops. The coalition will engage local community-based organizations (CBOs) to promote biomanufacturing careers and provide critical support to help individuals overcome the barriers that often prevent marginalized populations from accessing the on-ramp into the industry (Appendix 2iv).

**Metrics of Success.** The primary metric of success will be the creation of new high-quality biotech/biomanufacturing jobs throughout the coalition that address the employment gaps in rural,

urban, and underserved communities specifically outside of the Boston/Cambridge area, and in metro-West Massachusetts, Rhode Island, and Maine. We will measure job quality in terms of wages, skill development, and the potential for career laddering and advancement. We will measure job creation over the next three years in terms of both number of job postings for new positions using data from Burning Glass Technologies (BGT) as well as number of jobs filled (e.g., employment) as reported by the Bureau of Labor Statistics (BLS). We will also prioritize training a more diverse workforce that serves traditionally marginalized populations as measured by closing the gap in unemployment rates across more affluent versus low-income areas within the region. In this way we will move the needle in providing a biotechnology workforce more aligned with the demographic breakdown of New England.

**Potential Barriers to Project Implementation.** Large, multi-stakeholder partnerships can be complicated to manage; however, all coalition members have experience managing complex projects and have strong partnerships with industry and regional economic development organizations (Appendix 2i and 2ii). Engaging a set of diverse trainees may be a challenge due to the need to identify and then prepare students who do not have access to industry. Thus, to create a pipeline of diverse trainees, the coalition plans to engage people in their own communities based on existing platforms (Appendix 2i and 2ii)

**(2) Regional Assets** are described in Appendix 2i. **Coalition Members:**

- *Northeastern University: Biopharmaceutical Analysis and Training Laboratory (BATL)* is a source for training—through experiential learning—on the intricacies of biopharmaceutical products across academia, industry, and government. *The Roux Institute at Northeastern University*, based in Portland, ME, was formed with the explicit goal of increasing economic development at the intersection of artificial intelligence (AI) and the life sciences.
- *Worcester Polytechnic Institute:* WPI is a leader in purpose-driven, project-based, student-centered education and research. WPI’s geographic location in the Commonwealth of Massachusetts is an asset to the development of research and training programs in advanced biomanufacturing.
- *Gloucester Marine Genomics institute (GMGI):* The Gloucester Biotechnology Academy at GMGI operates a biomanufacturing learning laboratory and classroom. GMGI has trained underserved, career-compromised young adults with high school diplomas to become biotech and life science lab technicians with graduation and career placement rates that outpace national norms.
- *Massachusetts Life Sciences Center (MLSC):* The Massachusetts Life Sciences Center is an economic development and investment quasi-public agency of the Commonwealth of Massachusetts with a mandate to expand life sciences-related employment opportunities in the Commonwealth and to promote health-related innovations by supporting and stimulating research and development, manufacturing, and commercialization.
- *RI Commerce (RICC)* is a quasi-state agency focused on economic development initiatives for the state of Rhode Island. RICC has worked with multiple companies over the last few years that have established and grown biomanufacturing facilities in the state. RI Commerce has utilized existing programs to support the growth of biosciences including: Rebuild RI for physical brick and mortar buildouts including lab space and manufacturing facilities (up to \$15M in tax credits per project); Innovation Vouchers for R&D support; and Industry Cluster Grants. Bioscience is an identified priority for investment in RI’s *Rhode Island Innovates 2.0* report, which is RI’s interim CEDS.

**(3) Industry Leadership.** An extensive industry leadership plan is presented in Appendix 2ii. Industry leadership is critical to the success of each of the proposed projects as well as continued relevance of the coalition and deploying active industry advising is a proven strategy already employed by each coalition member within their respective organizations. An Industrial Leadership Board (ILB) will report to the Coalition’s Leadership Committee and is expected to include a breadth in expertise, a knowledge of parallel development efforts regionally and nationally, and be broadly diverse (including gender, racial, geographic, and institutional representation).

**(4) Sustainability.** A comprehensive sustainability plan is provided in Appendix 2iii. Briefly, the proposed coalition is well aligned with existing market and workforce development needs within the industry sector of biomanufacturing. Each coalition member has created strong partnerships and collaborations within this industry sector as well as with public and community-facing agencies that will be strengthened to ensure sustainability beyond the EDA’s initial investment.

**(5) Equity.** A comprehensive equity plan is provided in Appendix 2iv. Intentional, cross-cutting activities will be created with industry and community input to ensure the proposed investment from EDA reaches underserved communities from the project’s ideation, construction, implementation, to future impact.

Table 1: General Timeline for Implementation

Date	Project Activity	Activity	Milestone
Year 1	Community outreach (all hubs) and workforce training	Architectural plans	Trainings
	Planning for lab space build-out and capital needs Prototyping and scale-up on new technologies at BATL		Construction
Year 2	Community outreach (all hubs) and workforce training	Curricula	New Core curricula
	Build-out of lab space and other capital needs Prototyping and scale-up on new technologies		Construction
	Core curriculum created		
Year 3	Community outreach and workforce training	New space opened	Trainings
	Completion of laboratory space Prototyping and scale-up of technologies		Construction complete
Year 4	Community outreach (all hubs) and workforce training	Training and prototyping	Trainings and Prototyping
	Prototyping and scale-up of new technologies (all hubs)		
Year 5	Community outreach (all hubs) and workforce training	Training and prototyping	Trainings and Prototyping
	Prototyping and scale-up of new technologies (all hubs)		

**(6) Feasibility.** The proposed coalition has deep experience managing complex collaborations, education and workforce programming, and infrastructure projects Table 1. First, the coalition will identify the necessary training modules and hands-on experiences and create a core curriculum to be used across the network. This will address an immediate need in workforce demand. Simultaneously, build-out of the training laboratory and prototyping space will begin in Rhode Island and Maine. Over years 4-5 of the grant, all the programs will be operational across all the coalition hubs supporting workforce development and prototyping of novel technologies. The coalition anticipates hiring a full-time project manager to support Phase 2 activities, and each component project will be supported by a detailed Project Management Plan with explicit risk mitigation measures.

**(7) Capacity: Accessibility of Matching Funds.** The coalition has a strong track record of generating matching funds. The Massachusetts Life Science Center (MLSC) has invested approximately \$10M at GMGI, BATL, and BETC to support biomanufacturing throughout the State of Massachusetts. Within Maine, The Roux Institute has received \$200M in gifts and both the Harold Alfond Fund (the largest private foundation in the state) and *The Initiative for Digital*

*Engineering and Life Sciences (IDEALS)* have provided letters stating their willingness to provide match for this project. In fact, IDEALS has offered to make available a 40,000 square foot building to serve as a laboratory and light manufacturing incubator space on economic terms that can serve as matching funds for the grant. RI Commerce has invested in life science trade organizations and accelerators such as: RIBIO, RIHUB, NEMIC, and in new biomanufacturing facility infrastructure through individual company biomanufacturing projects. In addition, RI plans to invest up to \$75M in a new lab center for the RI Department of Health, including space for spec lab development to support the growth of bioscience innovation. And RI pledges up to \$2.5M of its Innovation Campus fund for coalition-related co-investment.

**(8) Distress and Economic Opportunity.** The New England region has experienced greater employment losses than the rest of the nation during the COVID-19 pandemic due to more widespread disruption of economic activity at the onset. During 2020, employment declined more sharply in five of the six New England states compared to the nation (Appendix 3). Since the pandemic began, there has been a recognition among regional workforce development leaders in New England to “build back better” in both low-income rural areas and “Gateway Cities” serving immigrant populations and communities of color that face lingering social and economic challenges, yet retain many assets with unrealized potential. For example, Gateway Cities have existing infrastructure, transportation networks, university connections, and a disproportionately young and underutilized workforce that could readily support a regional economic development strategy centered around biopharmaceutical manufacturing. Yet as of July, unemployment rates in Massachusetts were significantly higher in Gateway Cities such as Brockton (8.8%), Lawrence (11.6%), Springfield (10.9%) and Worcester (7.1%) compared to the statewide rate (5.7%). Maine has its own set of challenges, as it has the lowest median income in the Northeast and is the most rural state in the country. Maine’s rural incomes (2018: \$43,563) are considerably lower and poverty rates higher (13.7%) than those in its urban areas (\$52,565 and 10.2%, respectively). Rhode Island’s unemployment rate is approximately 5.8%, with higher unemployment levels in urban core cities like Pawtucket (7.2%) and Woonsocket (7.3%).

There are some positive signs that the New England bioeconomy is emerging from the pandemic as an area of economic strength for the region, including the Massachusetts Gateway Cities, yet the inability to find skilled workers presents a serious challenge for this nascent industry. Online job posting data from Burning Glass Technologies shows biopharmaceutical manufacturing has been growing rapidly in all six New England states over the past decade (see appendix). Even during the pandemic, biopharma employment has continued to grow by as much as 5.5% in states such as Massachusetts with projected demand for an additional 40,000 jobs over the next three years. Yet as MassBio’s President Kendalle Burlin O’Connell noted, “We’ve reached an inflection point in Massachusetts—we must focus on expanding Massachusetts’ biopharma footprint beyond Boston/Cambridge, developing new biomanufacturing facilities, and recruiting, retaining, and educating the next generation of skilled talent to ensure Massachusetts remains the best place in the world for the life sciences.” A good example is Rubius Therapeutics, which developed its red blood cell therapy via research in Cambridge, MA and is building out its first biopharma manufacturing plant in Smithfield, RI, extending the ripple effect zone from the traditionally potent Cambridge hub to northern RI and creating a good precedent for these efforts.

**(9) Regional Investment.** The coalition builds on broad support from local and state government, philanthropic investment, and industry investment in each of the regions (Appendix 2i).