

## Practical Training Using Biotech Research, Manufacturing & Analytical Testing Organizations

The biotechnology workplace is typically very skills-centered and hence student preparation is best accomplished through hands-on, practical training strategies. Real research, manufacturing, and testing business environments have been created at a number of community colleges to provide this practical training. Three examples of these biotech business environments are described and compared here.

**InnovaBio™** is a contract research organization at Salt Lake Community College, started in 2004 with NSF Advanced Technological Education grant funding. Its primary goal was to create flexible research internship opportunities for college and high school students by putting them to work on real, supervised research and development or service projects from local life science companies. Students gain credible research experience while companies benefit from the availability of a low risk strategy for advancing lower priority projects. This results in an innovative partnership whereby local companies contribute to student learning by providing instruction, guest lectures, and contextual research experience.

**STUDENTfacturED** is a student-run biotechnology manufacturing company at Salt Lake Community College that provides a mechanism to shift learning away from the old school experience toward real-world contextual application. The company launched in January 2012 and placed its first cohort of biomanufacturing students to “work” alongside business students to collectively operate this business/training enterprise. The company’s business focus is on the production and sale of laboratory supplies to support biotechnology laboratory courses taught at the college, and at local high schools for college credit. The training side of STUDENTfacturED gives students an opportunity to apply their knowledge and skills in a real job setting, and thus gain valuable practical work experience. The authenticity of this experience makes it on-the-job training, *before the job*.

The **BioNetwork Analytical Training Laboratory** is an element of a statewide community college initiative that supports the development and growth of the life science sector in the state of North Carolina. An analysis in 2008 found that a gap existed in analytical chemistry training used in the life science industries because the high costs of the analytical systems and their upkeep prevented academic institutions from including anything but introductory content in their curriculum. Consequently, the BioNetwork Pharmaceutical Center expanded its scope in 2009 and developed an analytical training facility for hands-on skills development of individuals working or anticipating employment in the field of analytical testing and research. Since the program began, individuals in various aspects of the life science industry have received training, particularly incumbent workers, community college and university students and instructors (offered at no cost through BioNetwork’s sponsorship program), and unemployed and displaced workers needing new skills to enter the life science field.

Through operation of the training facility, it became clear that the hands-on component of the training program needed to be more portable to accommodate those who lived or worked more than 50 miles away and hence would incur significant travel and housing costs. Such costs appeared to be a burden to companies sponsoring incumbent workers. The solution is the creation of a *Mobile Training Laboratory*, which is a more cost effective way of housing and delivering the training (compared to typical brick & mortar facilities), especially to the more remotely located companies in the state, while maintaining a relatively low inventory of equipment overall. The mobile lab can be set up by leveraging the infrastructure of the existing facility and purchasing only a small amount of additional equipment.

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Attribute	 <small>INNOVATIONS IN CONTRACT RESEARCH AND SERVICES</small>	 <small>Made by STUDENTS for STUDENTS</small>	 <b>Analytical Training Lab</b>
<b>Organization Type</b>	Contract research organization	Contract manufacturing organization	Workforce training program
<b>Business</b>	Provides research services	Manufactures instructional supplies for biotech / life science courses	Provides theoretical and hands-on analytical training and regulatory training
<b>Primary customer</b>	Students – university, college & local high school	Students – currently SLCC, but will serve other university, college & high school students	Life science companies across NC
<b>Secondary customer</b>	Local life science companies with moderate to low priority research projects  Educators – SLCC (e.g. STEP grant project research), UVU faculty (ovarian cancer research)	Educators – SLCC, other college, & high schools  Potential to serve life science companies or individuals (client) looking for a contract manufacturer	Local community, community college and university students and educators
<b>Output</b>	Real-world project-based research, leadership, and teamwork training for primary customer  Research data for secondary customer	Real-world life science manufacturing company training for primary customer  Educational products for sale to secondary customer	Highly technical, hands-on skill training for primary and secondary customers.
<b>Current staff</b>	<ul style="list-style-type: none"> <li>• Director – Adam Blaszcak, PhD</li> <li>• Asst Director – Mary Nelson, PhD</li> <li>• Research Tech – Alejandro Pabon, MSc</li> </ul>	<ul style="list-style-type: none"> <li>• Project PI – Vivian Ngan-Winward, PhD &amp; Biomanufacturing Program Director</li> <li>• Biomanufacturing faculty – Cheryl Marzec</li> <li>• Accounting faculty – Bob Burdette</li> <li>• Marketing faculty – Barbie Willet</li> <li>• Business Mgmt faculty – Don Skousen</li> </ul>	<ul style="list-style-type: none"> <li>• Director – Ryan Gilmore</li> <li>• Instructor/Analyst – Tara Massie, PhD</li> <li>• Instructor/Lab Technician – Mia Hawotte</li> <li>• Adjunct Instructors working in Life Science companies</li> </ul>
<b>Funding history</b>	NSF ATE DUE 0402497 May 15, 2004 – April 30, 2008  State of Utah budget line item 2007 to present	NSF ATE DUE 1003292 July 15, 2010 – June 30, 2013	State of North Carolina Division of Community College System
<b>Challenges</b>	Finding the right staff – key personnel need to have the right personality to work with students combined with outstanding research expertise; key personnel expertise and prior research experience is	Finding the right staff – key personnel need to have the right personality and expertise to fully engage in developing the business enterprise’s infrastructure as well as be good mentors to students	Providing training to companies that have very strict work schedules; many companies have a hard time getting manufacturing personnel into trainings due to demanding production schedules.

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	<p>critical as projects are largely determined by these factors; to function as a real business enterprise, staff must have high-level leadership and managerial skills to meet deadlines and deliver valuable results to clients; good communication and relationship-building skills are also essential for effective creation of customer base from local biotechnology companies</p> <p>Collaboration – identifying appropriate research projects and initiating / maintaining productive business relationships with companies</p> <p>Sustainability – very difficult; bulk of cost is labor for staff and current operational model (mainly charging secondary customer for supplies, and equipment if necessary) does not yield enough profit to cover the cost of highly skilled labor</p>	<p>Collaboration – working with personnel from another area of the college can be challenging on a number of fronts (e.g. finding right individuals, scheduling meetings)</p> <p>Sustainability – good potential, using profit from selling products</p>	
<b>Legal issues</b>	<p>IP – remains with the company client</p> <p>Nondisclosure – although students sign an agreement prior to beginning work with InnoVaBio, agreement is not enforceable by company client</p> <p>Working with minors (high school students) – nondisclosure issue</p>	<p>IP – if develop novel product, then who owns IP (SLCC, or faculty/students)? Will need to determine an answer to this prior to 1<sup>st</sup> round of product design/development</p> <p>Nondisclosure – could come into play if have novel product or serve as contract manufacturer for client</p> <p>Working with minors (high school students) – IP rights issue</p>	None
<b>Project-based learning method</b>	<p>Need to complete training packet first</p> <p>Next, works on research project</p>	<p>At this time, coursework is prerequisite</p> <p>Students will take on function(s)</p>	<p>Participants are given theory first, then lab experiments to practice the concepts and skills learned.</p>

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	<p>as a team member, with staff as mentors</p> <p>May move up to the leadership role on a project</p>	<p>in STUDENTfacturED company, with staff as mentors</p>	
<b>Work with other depts/ programs</b>	<p>A research project that leads to a manufacturable product would yield a collaboration with STUDENTfacturED</p> <p>Students from other SLCC depts have received research training (Biology &amp; Chemistry)</p> <p>Mentor and support replication and dissemination of InnovaBio model at other educational institutions both locally (UVU) and internationally (Poland)</p>	<p>A need to design and/or develop a novel product would yield a collaboration with InnovaBio</p> <p>Potential to work with other SLCC depts:</p> <ul style="list-style-type: none"> <li>• English: for technical writing, to support document preparation</li> <li>• Engineering / Engineering Design &amp; Manufacturing Technology: for making simple equipment and devices, including custom manufacturing equipment</li> </ul> <p>Potential to collaborate with other ATE centers (e.g. manufacturing tech) and other colleges/universities</p>	<p>Works well with Chemistry Department at the local community college to offer curriculum assistance and access to analytical equipment to their organic and analytical chemistry courses.</p> <p>Provide Nanotechnology Program at the local community college with lab space and equipment to offer ways of identification and separation for nano labs.</p> <p>Many potential collaborators within community college system to offer lab space and training for educators and other students.</p>
<b>Future directions</b>	<p>Leadership Academy</p> <p>International research exchange program with other CROs and/or research institutions</p> <p>Potential to collaborate with other CROs</p>	<p>Add engineering component to company</p> <p>Become ISO 9001 certified</p> <p>Vie for the Malcolm Baldrige National Quality Award</p> <p>External customers – true contracting</p>	<p>Mobile Training Laboratory</p>
<b>Publications</b>	<p>Have opportunity to publish research data, with company client approval</p> <p>Can publish best practices for project-based learning in education related venues</p>	<p>Can publish to disseminate project progress as well as best practices for project-based learning in education-related, quality, and entrepreneurship venues</p>	<p>None at this time</p>