# *Response to SB402*

## *Appendix*

**February 28, 2014**

North Carolina Biotechnology Center

*ncbiotech.org*

## NCBiotech / Response to SB402

# Table of Appendices

The Honorable Philip Edward Berger
President Pro Tempore
North Carolina Senate
16 W. Jones St., Room 2008
Raleigh, NC 27601-2808

The Honorable Thom Tillis
Speaker
North Carolina House of Representatives
16 W. Jones St., Room 2304
Raleigh, NC 27601-1096

Copy To: Governor Pat McCrory, Secretary of Commerce Sharon Decker, Sen. Harry Brown, Sen. Peter S. Brunstetter, Sen. Neal Hunt, Sen. Andrew Brock, Sen. Brent Jackson, Rep. Nelson Dollar, Rep. Justin Burr, Rep. Bryan Holloway, Rep. Linda Johnson, Rep. Pat McElraft, Rep. Roger West

April 10, 2013

Senator Berger and Speaker Tillis:

As business leaders in North Carolina's successful and growing life science community, we encourage you to maintain full funding for the North Carolina Biotechnology Center. With continued funding for the Biotechnology Center's programs, North Carolina will be well-positioned to continue to capture this sector's growing number of high-paying jobs.

We are a part of a 500-plus company industry sector that brings more than 58,000 jobs to the state. In total, our sector generates more than $59.0 billion in economic activity and supports 237,000 total jobs for North Carolina. These 237,000 jobs represent a combined annual payroll of $14.8 billion and state and local revenues of $1.73 billion.

The Biotech Center is our key driver, coordinator and facilitator. The Biotech Center team understands the specific infrastructure and permitting needs for our sites, and they bring together the right people to solve those challenges. The Biotech Center documented our training needs more than a decade ago, and programs that they put in motion have made it easy for us to hire the highly-skilled workers we need. For some of our companies, Biotech Center loans helped us sustain growth and leverage more funding when no other investment was available.

Biotechnology is one of the great success stories for North Carolina, with tremendous potential for future growth. Other states envy our Biotech Center and industry success – our 23.5 percent employment growth is the fastest of the leading biotech states. We urge you to keep funding flowing to the North Carolina Biotechnology Center. The Biotech Center represents a competitive advantage, leadership position and high-paying jobs that North Carolina can't afford to lose.

Sincerely,

Fred N. Eshelman
Furiex Pharmaceuticals

John F.A.V. Cecil
Biltmore Farms

Christopher McDonald
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Joy Parr Drach
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**Supporting Signatures**

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Miles Wright
CEO
Xanofi Inc.

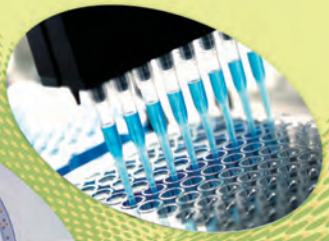
Peter Pieraccini
President and CEO
Zen-Bio Inc.

# 2012 Evidence and Opportunity:
# *Impacts of the Biosciences in North Carolina*

Prepared for:
North Carolina Biotechnology Center

Prepared by:
Battelle Technology Partnership Practice

January 2013



# EXECUTIVE SUMMARY

This third biennial independent assessment of the economic impacts of bioscience industry development in North Carolina found that the state's industry not only withstood the toughest of economic times, but in the bottom-line measures of direct job creation, employment impacts and industry competitiveness, continued to advance through the severe recession and weak economic recovery.

These findings point to just what a remarkable success story bioscience industry development has been in North Carolina. In 1984, when just a few companies were applying the new advances in a fledgling field known as biotechnology, the State of North Carolina created the unique model of the North Carolina Biotechnology Center (NCBiotech) to be a catalyst and resource for sustaining economic development in this emerging field. The Center represented the world's first government-sponsored commitment to advancing biotechnology-based economic development with a focus on public-private partnerships and filling key gaps to ensure the growth of this industry in the state.

Few realized in 1984 just how transformative biotechnology would be and how it would open the door to more traditional bioscience industries to develop in North Carolina. Advances in biotechnology have reshaped all aspects of biomedical development from the way we study medicine, discover and develop therapeutics, and diagnose and treat diseases and medical conditions for both humans and animals. Furthermore, advances in biotechnology are having similar transformative impacts on agricultural biosciences for improving, protecting and enriching plants, as well as giving birth to a new industrial biotechnology sector generating bio-based fuels and specialty chemicals.

North Carolina is now among the largest states in bioscience industry development in the U.S. Today, the past distinctions between a biotechnology company and a pharmaceutical or medical products company have fallen away as biotechnology techniques and knowledge are being applied in all traditional bioscience industries.

Looking to the future, the prospects of continued advances in the biosciences look bright. As the National Research Council explains in its study *A New Biology for the 21st Century,* advances in the life sciences have the potential to contribute innovative and mutually reinforcing solutions to global-reaching, societal challenges related to food, environment, energy and health, and at the same time, serve as the basis for new industries that will anchor the economies of the future.[1] A recent OECD study of the bio-economy estimates that based on recognized advances in biological sciences with a high probability of reaching the market, it is expected by 2030 that these bioscience innovations could contribute up to 35 percent of the output of chemicals and other industrial products, 80 percent of pharmaceuticals and diagnostic production, and 50 percent of agricultural output worldwide.[2]

Below are the key findings from this third biennial assessment of the economic impacts of bioscience industry development on North Carolina and the contributions of NCBiotech. The methodology for measuring these economic impacts remains the same as in past years. In order to provide the most current industry employment data to develop economic impacts of the biosciences in 2012, the NCBiotech database of bioscience companies is used. This unique and North Carolina specific database involves ongoing tracking of individual firm employment in the state, including direct outreach to firms by NCBiotech staff. Up-to-date figures through the end of the second quarter were used in generating these results.

[1] National Research Council, A New Biology for the 21st Century, National Academy of Sciences, 2009.

[2] OECD, The Bioeconomy to 2030, 2009, page 199.

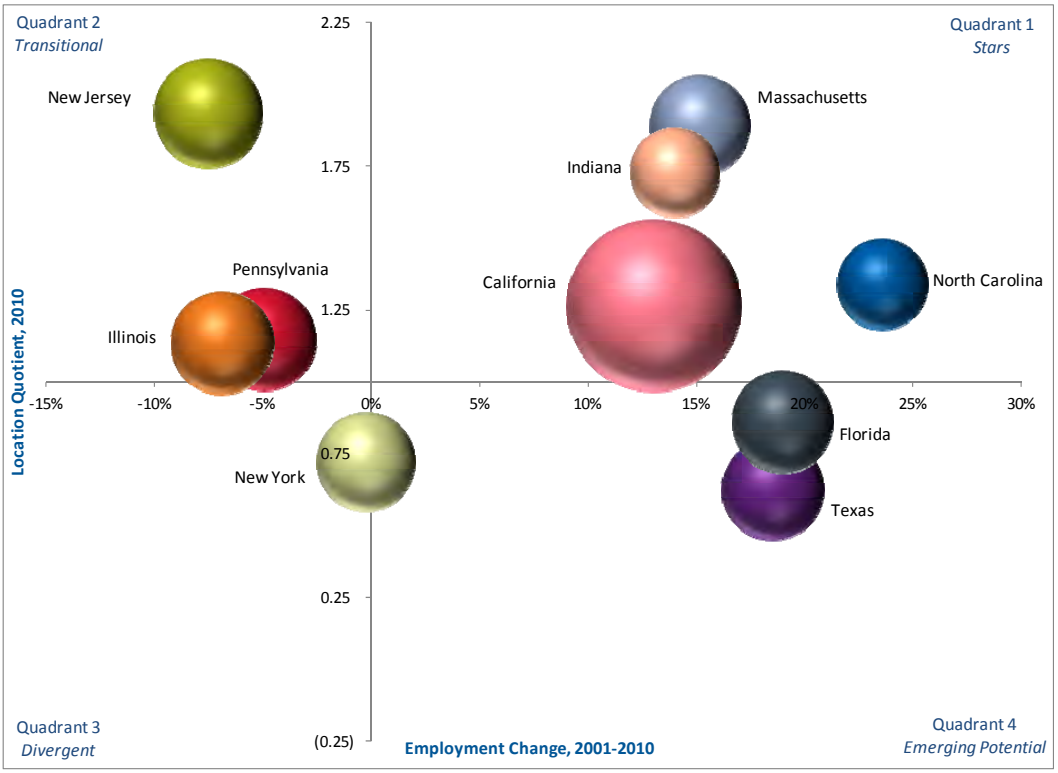
To compare North Carolina to other states, the report uses the Biotechnology Industry Organization's (BIO) definition of the bioscience industry that was developed jointly with Battelle based on selected North American Industry Classification System sectors and measured by industry employment levels reported in the Bureau of Labor Statistics Quarterly Census of Employment and Wages and maintained by IMPLAN. The latest year available for state by state comparisons is 2010. This BIO-Battelle definition was first developed in 2002, and given the changing nature of biological research and its commercial applications, was recently revised in 2012. The biggest change was adding bioscience-related distribution recognizing that the increasingly specialized approaches undertaken in the distribution of drugs, medical devices, and other bioscience-related products includes cold storage and highly-regulated product monitoring as well as new technology for distribution such as automated pharmaceutical distribution systems warrant its inclusion as a major industry subsector.

## **Competitive Strength Revealed:** North Carolina Stands Strong in Bioscience Industry Growth over the Past Decade and Through the Recent Recession to Recovery Period

North Carolina stands out in its rapid growth in the biosciences over the past decade, even compared with national leaders in the sector. Figure ES-1 presents the current employment position for North Carolina and the other states ranked in the top 10 in terms of overall bioscience employment. **Among the ten largest bioscience employer states, North Carolina's 23.5 percent job growth since 2001 has been the fastest**. Since 2001, this translates into nearly 12,000 new jobs in the biosciences for North Carolinians, a total job gain surpassed only by California, Florida, and Texas, three much larger states.

Five of the ten largest bioscience employer states, including North Carolina, have a specialized concentration of employment (meets or exceeds a location quotient of 1.20 or at least 20 percent of the national average concentration of employment). These five states are: New Jersey (Location Quotient is 1.93), Massachusetts (LQ is 1.89), Indiana (LQ is 1.73), North Carolina (LQ is 1.34), and California (LQ is 1.26).

**Figure ES-1: Total Bioscience Sector, Degree of Specialization, Employment Growth, and Size, Ten Largest U.S. Bioscience Employer States, 2001–2010**

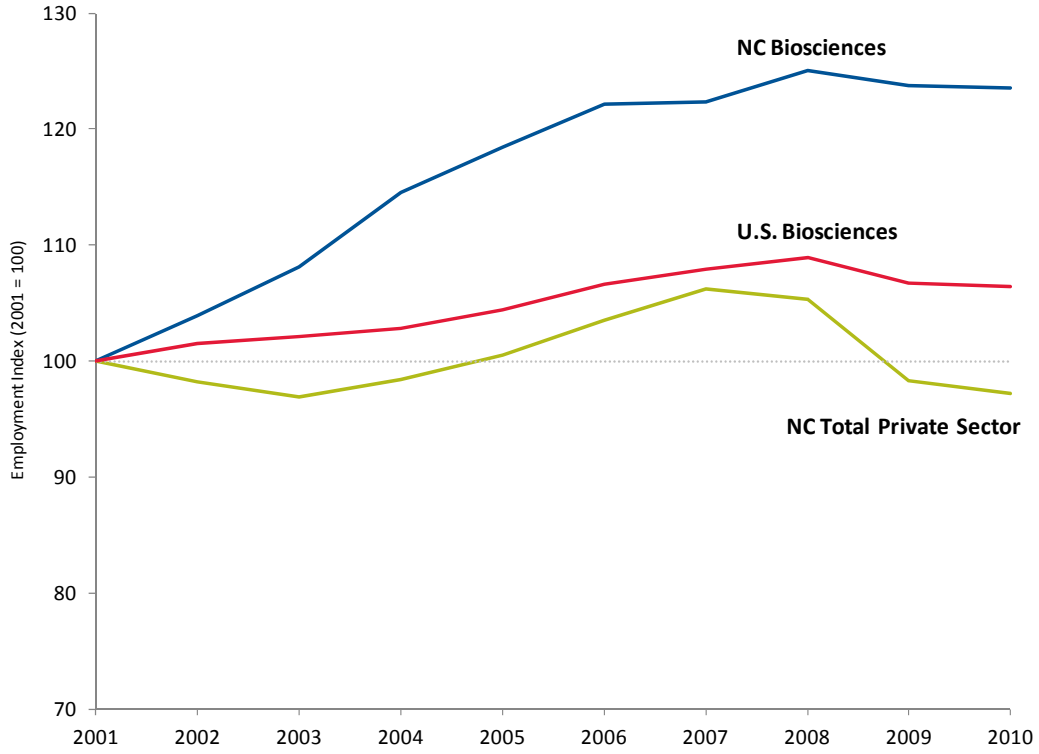


Another sign of the varied and robust nature of North Carolina's bioscience industry base is that it is just one of eleven states nationally with a specialized employment concentration in three or more of the five bioscience subsectors. It has a specialized location quotient in: drugs and pharmaceuticals (LQ is 2.34); research, testing, and medical labs (LQ is 1.39); and agricultural feedstock and chemicals (LQ is 1.20). Since 2001, four of the five major bioscience subsectors contributed to the state's substantial overall job growth with only the smallest sector, agricultural feedstock and chemicals, shedding jobs.

## **Bolstering the State's Economy In Tough Economic Times:** Growth of North Carolina's Bioscience Industry through the Recession and Recovery even as the State's Overall Private Sector Declined Sharply

While bioscience industry employment in North Carolina held its own and even grew slightly through the recession and early years of recovery, private sector employment in North Carolina fell sharply. From a pre-recession high of 3.4 million jobs, private sector jobs fell to a low of 3.1 million in 2010. So, the bioscience industry has helped bolster the state's economy in tough economic times.

**Figure ES-2: Employment Growth in North Carolina's Bioscience Sector, 2001–2010**




Compared with other top bioscience states, from the economic peak in 2007 through the recession and initial year of recovery in 2010, North Carolina was just one of four states to have added employment. Two of the largest employer states—New Jersey and Pennsylvania—have seen significant job loss as a result of the recession. These states have been especially hard hit by declines in the drugs and pharmaceuticals subsector which has cut jobs in recent years.

## **Rising Statewide Total Employment Impacts as Bioscience Industry Cluster Development Intensifies:** Continued Growth of North Carolina's Bioscience

## Industry is Creating Deeper Connections and Higher Multiplier Impacts in the State

The growth of the bioscience industry cluster also boosts North Carolina's supply chains that support this industry. The result is that the total employment impact of each bioscience industry job in generating additional jobs in North Carolina is growing—in other words, with greater cluster development comes rising employment multipliers across North Carolina's economy. This benefit of increased agglomeration is reflected in the IMPLAN Input/Output models through its regional purchase coefficients. Table ES-1 provides the results over time of how direct bioscience jobs impact broader employment in North Carolina.

Of particular note is that the total employment impact of the bioscience industry in North Carolina rose an impressive 57,658 jobs or 32 percent from its level of 180,007 jobs in 2008 to 237,665 in 2012. Helping to drive this considerable rise in total employment impact of the bioscience industry in the state is the higher employment multiplier in North Carolina, so that each direct job in the bioscience industry in 2012 accounts for slightly more than 4 total jobs in the state compared to 3.4 jobs in 2008.

**Table ES-1: Comparison of the Employment Impacts from the Economic Contribution of Biotechnology/Bioscience Sector to the North Carolina Economy, 2008, 2010 and 2012**

| Item | 2012 | 2010 | 2008 |
|---|---|---|---|
| **Total Biotechnology Sector** | | | |
| **Direct Impact (Employment)** | 58,589 | 56,842 | 53,182 |
| **Indirect Impact (Employment)** | 84,654 | 84,494 | 64,913 |
| **Induced Impact (Employment)** | 94,422 | 84,487 | 61,913 |
| **Total Impact (Employment)** | 237,665 | 226,823 | 180,007 |
| **Total Employment Multiplier (Total Impact Divided by Direct Impact)** | 4.056 | 3.990 | 3.385 |

Source: Battelle analysis of NCBiotech data using IMPLAN.

As a result of local and national economic conditions, the sector's growth in employment did not translate into an increase in the value of the sector's output or revenues. In a recession, the level of output or sales per job declines reflecting the weaker economic conditions. Given the weak national recovery, output did not rise relative to employment as might be expected in the first year of a recovery. Therefore, it is not surprising that despite the rising level of direct employment in the biosciences, the industry's output generated fell from previous years. Moreover, this decline in post-recession output is not concentrated in the bioscience sector—it occurred across most sectors of the North Carolina economy and occurred nationally as well. Thus, these results are consistent with both overall state and national economic changes.

## **A Proven Bioscience Catalyst Continues to Generate Economic Dividends:** North Carolina Biotechnology Center (NCBiotech) Continues to Have a Growing Impact on Bioscience Development and the North Carolina Economy Overall

Along with the growing employment base, the contributions of NCBiotech to the North Carolina economy have continued to rise, resulting in expanded state and local tax generation. The following tables present the total impacts on the state's economy from ongoing companies in 2012 (compared with previous years) who received loans from NCBiotech (Table ES-2) as well as the total impact of NCBiotech operations/programmatic spending on the state's economy (Table ES-3).

**Table ES-2: The Economic Contribution of Currently Active Companies that Received Business Loans on the North Carolina Economy, 2008, 2010, 2012**

| Item | 2012 Total Impact | 2010 Total Impact | 2008 Total Impact |
|---|---|---|---|
| **Number of Companies** | **74** | **83** | **64** |
| **Output ($M)** | **$2,386** | **$1,355** | **$818** |
| **Employment (# of Jobs)** | **9,586** | **5,513** | **3,734** |
| **Labor Income ($M)** | **$608** | **$303** | **$193** |
| **State and Local Tax Revenues ($M)** | **$71** | **$44** | **$27** |

Source: Battelle analysis of NCBiotech data using IMPLAN.

**Table ES-3: The Economic Contribution of NCBiotech Operational/Programmatic Spending on the North Carolina Economy, 2010 and 2012 Report (one year lag)**

| Item | 2012 Report Total Impact | 2010 Report Total Impact |
|---|---|---|
| **Output ($M)** | **$39.4** | **$35.9** |
| **Employment (# of Jobs)** | **256** | **239** |
| **Labor Income ($M)** | **$14.0** | **$12.3** |
| **State and Local Tax Revenues ($M)** | **$1.7** | **$1.6** |

* Data for 2008 are not included. The approach in 2008 was not comparable given that research spending was included, but excluded in future years so as not to double count.

Source: Battelle analysis of NCBiotech data using IMPLAN.

Battelle
The Business of Innovation

# *Target Ag Biotech Development*

## Recommended Appropriation: $450,000 (Recurring)

**OVERVIEW:** As highlighted by Battelle in 2010, North Carolina has a unique strength in this sector. The state has five of the top six agricultural biotechnology firms and strong institutional research in ag biotech. While demand for agricultural products is projected to rise—global food demand will double by 2050—opportunities in this sector are largely unexplored by other states. With targeted action in this sector, North Carolina can establish a strong leadership position.

Two specific, short-term projects will help achieve that leadership: the North Carolina Crop Commercialization Center and the North Carolina International Ag Biotech Business Portal.

**STATES WITH SIMILAR PROGRAMS:** California, Illinois, Iowa, Kansas, Missouri, Ohio, Tennessee and Virginia

## *North Carolina Biotechnology Crop Commercialization Center*

### Purpose and Function

The North Carolina Biotechnology Crop Commercialization Center (BCCC) has a core function to commercialize new biotech niche specialty vegetable, fruit and feed crops, including trait identification, development, grower engagement and market introduction. Technologies for new or enhanced crops may be owned by companies or developed by universities. All projects are expected to be public/private collaborations.

#### *Structure and Process*

The following activities will be performed or coordinated by the Crop Commercialization Center:

- Determine market need for new or enhanced North Carolina crops, commodities or value-added agriculture sectors
- Identify/recruit company/university technologies that match market need
- Develop proof of concept from field to market for crop or trait selection
- Develop project business plan with milestones
- Contract research such as field testing, feeding studies

The first project is the development of new and enhanced grain crops for the state's $6 billion (farmgate) livestock industry with an initial focus on swine.

#### *Expected Outcomes*

The BCCC is virtual and functions within the AgBiotech Initiative of the Biotechnology Center. The Center intends to meet market needs by accelerating biotech crop technology. Both non-transgenic and transgenic-based projects will be identified. These could run on concurrent tracks of development. The result will be new crops and products for human health, protein production, nutrition and niche markets important to North Carolina. These products increase farm and agribusiness revenue as well as jobs.

## *North Carolina International Ag Biotech Business Portal*

**PURPOSE:** To accelerate market entry and economic development of international and domestic ag biotech companies into North Carolina. With the increased visibility, marketing and leadership of the AgBiotech initiative at NCBiotech, international and domestic companies are now looking at North Carolina as a technology business destination. This will aid recruitment of these companies and technologies to our state to increase jobs and revenue.

**TARGETS:** International and domestic ag biotech companies seeking to enter U.S. markets and specifically North Carolina.

### *Portal Business Service Advantages for Recruiting Companies/Technologies*

- Preferred destination and entry point for ag biotech companies (animal, plant, marine, forest)
- Turn-key environment for conducting business when visiting the state
- Temporary office with phone and data services
- Central point to establish connections with governments, research universities, research parks, business incubators, partnering companies, licensing venues
- Complete manual on "How To Do Business in North Carolina"

# *Ag Biotech: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **California** | Four of California's state universities formed the California State University Agricultural Research Institute. The cross-institutional research effort targets agriculture, environmental and other problems faced by California's extensive agriculture industry. Of the more than 700 projects undertaken by these researchers, about 100 are specific to ag biotechnology. Research funding comes primarily from federal grant programs, and operational costs were funded by the state legislature in 1999. |
| **Kansas** | Kansas has been chosen as the future home to the National Bio- and Agro-Defense Facility, which is a bio-containment facility. Researchers there will study emerging and zoonotic (transmitted from animals to humans) diseases that threaten U.S. animal agriculture and public health. North Carolina was a finalist in the selection process for this site. The state of Kansas contributed more than $200 million in direct and in-kind support for the lab. |
| **Illinois and Missouri** | Three universities—the University of Illinois, Southern Illinois University and the University of Missouri—collaborate on research that aims to increase the number of profitable businesses in the food and agricultural sector. The Illinois-Missouri Biotechnology Alliance initially focused on corn and soybeans, but now includes a range of industries and services that are related to corn and soybean production. Funding comes from a special grant administered by the USDA. |
| **Iowa** | Iowa is the leading producer of corn, soybeans, eggs, pork and biomass. It's home to 128 ag chemical and feedstock companies, including DuPont Pioneer, headquartered in Des Moines. The state's strong specialization in this area, as reported by Battelle, and its substantial acreage dedicated to farming, make it a leading choice for agricultural research. Iowa began working on its ag biotech initiative in 1985, with a plan to recruit molecular biologists to Iowa State. Steve Leath, former vice provost of research for the University of North Carolina system, hit a competitive note as the new Iowa State University president, **promising to bring North Carolina's best ag biotech researchers to Iowa.** |
| **Missouri** | St. Louis is home to the internationally recognized Danforth Center, which includes research laboratories, training facilities and support infrastructure that includes a library, auditorium and video collaboration. Scientists from across the region receive support from the Danforth Center, which currently conducts research in biofuels, biofortification (nutrition), disease resistance, drought tolerance, pesticide and fertilizer reduction, and biosafety and regulation. In addition to significant private support from the Danforth Foundation and Monsanto, the Danforth Center received $25 million in tax credits from the state of Missouri.. |
| **Ohio** | Located in Wooster, the Ohio Agricultural Research and Development Center (OARDC) is the research arm of The Ohio State University's College of Food, Agricultural, and Environmental Sciences. The center targets better food and fiber production, environmental and water quality issues for both rural and urban populations, and continued emphasis on new, improved and safer products for use in the agricultural endeavors. OARDC began 121 years ago as part of the federal land-grant institution legislation, and evolved to its present research facility supported by state and federal funds. |

| STATE | SUMMARY |
|---|---|
| **Tennessee** | AgBioWorks, an initiative of Memphis Bioworks Foundation and BioDimensions, develops new agricultural technologies and processing. The initiative is focused on the Mississippi Delta (Arkansas, Kentucky, Mississippi, Missouri and Tennessee) and technologies that contribute to the sustainable use of agricultural and forestry products to supply abundant food, biofuels and bio-based products. Successes so far include a $450 million research park, an early-stage bioscience investment fund, a new crops database, and an 800-student charter school. The foundation is a public-private partnership that is funded by state and local governments, grants and private donations. |
| **Virginia** | The Virginia BioTechnology Research Park in Richmond established a biosciences development center, the Virginia Biosciences Development Center (VBDC). The 27,000-square-foot space provides laboratory and office space, as well as business support services for its companies. The incubator has helped to launch more than 50 companies in seven years.<br><br>Building on that expertise and experience, the research park created the Virginia Israel Biosciences Commercialization Center. Its goal is to give Israeli bioscience companies an entry point to U.S. markets as well as a place to locate. North Carolina could model this portal concept in ag biotech. |

# *Complete Pilot Extraction Facility*

## Recommendation: $1,000,000 (Non-recurring)

**OVERVIEW:** Build a pilot-scale extraction facility in Northeastern North Carolina. The facility brings jobs to the region by capitalizing on local resources and an increasing demand for extracted products.

**RATIONALE:** Northeastern North Carolina is home to rich agricultural resources and ag biotech education programs, as well as one of North America's three extraction facilities. An independent analysis by RTI International identified an opportunity to group these resources and skills together to establish a commercialization partner for specialty crops.

Biotech crops will follow a set path to the market: a need is identified; a research lab finds a solution; farmers will test the solution; the final product will go to market, maybe via an extraction facility. Northeastern North Carolina can support each stage of development with a three-pronged approach: deploy researchers from the Vernon James Research Center as liaisons between research, farmer and company; educate farmers through a certification process; build a pilot-scale extraction facility. This recommendation addresses the facility.

**DISCUSSION:** Demand for extraction services is increasing, as is the need for test-sized batches of product. Currently, researchers experience long wait times to test the product of their research, determining which crops are the most valuable and/or profitable. The Pilot Extraction Facility, a public/private partnership with Avoca Inc. in Merry Hill, provides a solution. The facility will perform a variety of extraction services for global customers as well as university researchers.

The facility itself will provide jobs. Farmers close to the facility will have the opportunity to grow high-value crops to be processed at the facility. As more acreage is grown, processing and packing companies can be recruited to the currently rural region. State funding for this project will ensure that the facility can be completed, starting this ripple effect.

**TRAINING:** Training is an important component of this proposal. High-school students are gaining broad exposure to ag biotech concepts at the Northeast Regional School of Biotechnology and Agriscience, which is located at the Vernon James Research Center. The community colleges' existing biotechnology-focused training programs can train technicians for these high-paying jobs. And a farmer certification program, initially called B-Cert, will help farmers understand the rigors of growing biotech crops.

# *Reinstate and Expand SBIR Matching Grant Program*

## Recommended Appropriation: $5,000,000 (Recurring)

**OVERVIEW:** Restore funding to the existing Department of Commerce program that provided matching grants to North Carolina businesses receiving early-stage Small Business Innovation Research (SBIR) grants from federal agencies. Refine the matching grant program structure to maximize the number of SBIR awards won by North Carolina companies.

**STATES WITH SIMILAR PROGRAMS:** Connecticut, Florida, Hawaii, Kansas, Kentucky, Michigan, Montana, Nebraska, Oklahoma, South Carolina, Virginia. In addition, Massachusetts and New Jersey have programs that match late-stage SBIR awards.

**RATIONALE:** Although North Carolina has one of the largest research and development communities in the nation, we rank well behind leading states in per capita funding from the federal SBIR and similar grant programs. Between 2006 and 2010, an SBIR matching grant program operated by the North Carolina Department of Commerce helped companies compete more effectively for SBIR/STTR grants.

Funding for the program was ended due to revenue constraints during the recession. Funding for North Carolina's SBIR matching grant program has not been restored, but recent changes in federal SBIR law have made state matching programs even more attractive. NCBIO estimates an appropriation of $5 million for SBIR matching grants could result in $26 million to $79 million in additional spending by North Carolina SBIR grantees annually.[1]

**DISCUSSION:** North Carolina's SBIR matching grant program provided up to $100,000 to North Carolina companies that received early-stage SBIR awards from the federal government. Between 2006 and 2010, the North Carolina program awarded 200 matching grants, with a total value of more than $15 million. Companies receiving these grants raised more than $85 million in follow-on investments.

In 2011, Congress changed the federal SBIR program, capping maximum award amounts. Because of the high cost of health research, the new caps will make it harder for federal agencies to fund meaningful health-related grant applications. NCBIO believes that companies that are able to augment their research grants with other funds will have an advantage in competing for early-stage SBIR grants. Conversely, companies that cannot augment their grants will be less competitive. NCBIO estimates that in North Carolina the availability of a matching grant program could swing between $7.8 million and $23.5 million in early-stage SBIR grants annually. If follow-on investments in grant-winning companies are considered, the impact of a fully funded SBIR matching grant program in North Carolina would range from $26 million to more than $79 million annually in new dollars for research-based start-up companies.

Some adjustments to North Carolina's historic SBIR grant-matching program would be necessary. For maximum impact, grant applicants would need to be assured of state matching funds if a federal grant is awarded. Restrictions on the number of matching awards per company should be eliminated or revised so as to maximize the number of federal awards eligible for state match.

1 See NCBIO, "Potential Benefits of the One North Carolina Small Business Fund After Changes to Federal Small Business Innovation Research Grant Program (1-May-2012)

# *SBIR: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **Connecticut** | The SBIR Phase I Matching Grant initiative is designed to help recent Connecticut SBIR Phase I winners advance their federal Phase I feasibility studies to million-dollar Phase II research awards. It encourages collaborations, especially with Connecticut universities. These grants were created to help bridge the funding gap between Phase I and subsequent awards. The matching grant may be increased if a company subcontracts with a Connecticut research university. |
| **Florida** | This program is designed to expand the research activities of a university industry partner by providing assistance in obtaining a Phase II SBIR/STTR award. Approximately $500,000 is allocated for the SBIR/STTR Phase II Industry External Investment program. |
| **Hawaii** | The Hawaii Small Business Innovation Research Grant Program was established in 1989 to provide grants to Federal Phase I SBIR awardees (up to 50 percent of Phase I Award.) The grant maximum is $25,000, and can only be used for research that is performed in the State of Hawaii. |
| **Kansas** | Funding is available under this program to match technology development awards to encourage commercialization of new products and technologies. The program can match up to 50 percent of such awards, proportionate to the amount of work performed in Kansas. |
| **Kentucky** | The Kentucky SBIR-STTR Matching Funds Program matched all Phase 1 federal awards received by Kentucky businesses after January 1, 2006 and all Phase II federal awards received after January 1, 2007. This includes matching awards of up to $100,000 to support Phase I exploration of the technical merit or feasibility of an idea or technology. Phase II federal awards, which support full-scale research and development, can be up to $750,000, and are matched by the Commonwealth up to the first $500,000. |
| **Massachusetts** | The Massachusetts Life Sciences Center operates a Small Business Matching Grant (SBMG) Program to provide grants to commercialization-ready life sciences and technology companies that have received at least the equivalent of a Phase II SBIR or STTR grant from federal agencies such as the National Institutes of Health, National Science Foundation, Department of Defense, etc. The Center is targeting an FY12 investment of $3 million in the Small Business Matching Grant Program. |
| **Michigan** | The Michigan Emerging Technologies Fund will match 25 percent of Phase I SBIR/STTR awards up to $25,000 and 25 percent of Phase II SBIR/STTR awards up to $125, 000. ETF awards will come in the form of grants and do not need to be paid back; however, ETF funds must be used to help bring Michigan SBIR/STTR projects to commercialization in at least one of the four technology sectors supported by the ETF. These sectors are: advanced automotive, manufacturing, materials, information and agricultural processing; alternative energy; homeland security and defense; and life sciences. |
| **Montana** | Grants to Montana companies that have been awarded a SBIR or STTR Phase I award and that, if the opportunity to do so is available, intend to apply for a SBIR/STTR Phase II award. |
| **Nebraska** | The Nebraska Small Business Innovation Research Initiative establishes a financial assistance program to individuals and businesses with a principal place of business in Nebraska to support applications to the SBIR Program (Phase 0) and the matching of successful applications (Phase I and II) by the state of Nebraska. The total funds available through this initiative will be a maximum of $1 million |

| STATE | SUMMARY |
|---|---|
| **New Jersey** | The purpose of the SBIR Bridge Grant program is to increase the success and maximize the growth of small New Jersey companies in moving from Phase I to Phase II. The program supports New Jersey's technology industry by awarding grants to entrepreneurs who have both applied for Phase II funding and who have been identified as potential Phase II SBIR/STTR awardees. This program will sustain small businesses through the funding gap which occurs between completion of the Phase I grant and the initiation of a Phase II award. Awards are $50,000. |
| **Oklahoma** | The OCAST SBIR Matching Funds Program is designed to award matching funds to Oklahoma firms that (1) have been awarded an SBIR Phase I award and (2) have submitted a qualified Phase II proposal to a participating federal government agency. |
| **South Carolina** | The SC Launch! SBIR/STTR Phase I Matching Grant Program provides up to 100 percent of the SBIR/STTR Phase I award, not to exceed $100,000. It is designed to provide support funds to South Carolina companies stepping through the development process, especially companies attempting to attain SBIR/STTR Phase II grant awards. |
| **Virginia** | The Virginia SBIR Match Program provides $50,000 to $500,000 in match funds for SBIR or STTR awards, depending on various factors such as state funding levels and company eligibility requirements. The program is operated by the Center for Innovative Technology (CIT). |

# *Expand Biotechnology Center Loan Programs*

## Recommended Appropriation: $2,500,000 (Recurring)

**OVERVIEW:** Expand funding to the Biotechnology Center loan programs. This increase would enable the Biotechnology Center to fund more startup and early-stage life science companies and to initiate funding to growth-stage companies facing the funding valley of death.

**STATES WITH SIMILAR PROGRAMS:** Colorado, Delaware, Georgia, Illinois, Kansas, Maryland, Massachusetts, Michigan, Minnesota, Ohio, Pennsylvania and Texas.

**RATIONALE:** Biotechnology Center loan funding has consistently led to job creation and company growth. As venture capital firms seek later-stage investments, NCBiotech loans are frequently the only option for early-stage biotech companies. Executives of many successful North Carolina-based life science companies have indicated that Center loan funding was critical to their companies' development and growth.

The NCBiotech loan program is well oversubscribed. Promising applications may not be funded under the current budget. A $2.5 million increase would propel job creation by funding more startup and early-stage life-science companies. This recommended appropriation would add $1 million to existing loan programs and allocate $1.5 million to initiate a program with larger loans to help companies bridge the funding valley of death.

**DISCUSSION:** The Biotechnology Center has awarded more than $22 million in loans to North Carolina-based life science companies since 1989. Those companies have brought in more than $2.6 billion in subsequent funding from sources such as venture capital groups, banks, strategic partners and federal granting agencies. That's $117 for every $1 loaned. Moreover, the great majority of these loans are fully repaid; loan principal payments have been more than four times the number of principal write-offs. This success rate results from detailed due diligence performed prior to loan decisions, as well as the connections and guidance that Biotech Center employees provide to loan portfolio companies. These companies have also added 2,830 jobs subsequent to loan award, resulting in a rate of roughly $2,500 in net loan disbursements per job created *(net loan disbursements = disbursements – principal payments – interest payments – warrant payoffs)*.

The Center manages three programs with loans ranging from $50,000 to $250,000 for activities from inception to growth. These loan programs are oversubscribed, and an increase in the loan budget would leverage major external funding rounds. This funding directly stimulates company and job creation. The later-stage loan program would enable companies to bridge the gap between Biotechnology Center funding and VC/strategic partner funding.

# *Loan Programs: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **Delaware** | The Delaware Economic Development Office manages two funding programs for high-tech companies, with a significant focus on biotechnology and life science. The Technology Based Seed Fund makes convertible debt investments of up to $100,000 in early-stage companies, while the Pre-Venture Fund provides debt and equity financing of up to $1 million to more established companies. |
| **Georgia** | The Georgia Research Alliance's VentureLab program provides grants to university researchers seeking to commercialize their discoveries, as well as loans to the early-stage life science companies that emerge from these efforts. While grants are capped at $100,000, loans can be up to $250,000 in size. The program has a total annual budget of approximately $2 million. |
| **Kansas** | The Kansas Bioscience Authority sponsors multiple funding programs for life science companies of all sizes, which can take the form of grants, loans, convertible debt, or equity investment. In the past year, the Proof of Concept Investment Program, which specifically targets early-stage companies, has awarded $688,000 in grants to six companies. |
| **Maryland** | The Maryland Biotechnology Center administers two Biotechnology Development Awards programs in Biotechnology Commercialization and Translational Research. These programs provide loans of up to $200,000 to enable early-stage life science companies to achieve R&D milestones on the path to commercialization. These programs have a total annual budget of $1.6 million. In addition, the state's Department of Business and Economic Development has awarded conditional loans of up to $1 million to promising early-stage companies. |
| **Massachusetts** | The Massachusetts Life Sciences Center's Accelerator Loan Program makes loans of up to $1 million to early-stage life science companies, with eligibility limited by the total amount of external funding raised by the company at the time of the award. All loans have a five-year term and an interest rate of 10 percent, and the Center also takes warrant coverage on all loans granted through the program. The total budget for the Accelerator Loan Program is $6 million for the 2013 fiscal year. |
| **Minnesota** | Minnesota's Agricultural and Economic Development Board oversees the Small Business Development Loan program, which makes loans of up to $5 million to companies with 500 or fewer employees, at a fixed market rate of interest. While not specific to the life science industry, the fund made at least one loan of $250,000 to a biotech startup in 2010. |
| **North Carolina** | The North Carolina Biotechnology Center manages three loan programs for inception- and early-stage life science companies. The maximum loan value ranges from $50,000 to $250,000, depending on the program; one program also requires a matching investment from an outside investor. The Center's total loan budget is $1.9 million for the 2013 fiscal year. All Center loans have a three-year term, with an interest rate of 1 percent above prime. The Center also takes warrant coverage on any loans greater than $75,000. |

| STATE | SUMMARY |
|---|---|
| **Ohio** | The Innovation Ohio Loan Fund provides support to companies in several high-tech sectors, including the life sciences. These loans can finance up to 75 percent of a project's qualifying costs, with a maximum award of up to $2 million. Loans have a negotiable term of four to six years, and carry an interest rate of 2 percent over prime. Loan recipients also pay a participation fee of 10 percent of the maximum drawn principal at the maturity of the loan, in lieu of the state's ability to take an equity position in the company. |
| **Pennsylvania** | The Pennsylvania Life Sciences Greenhouse Initiative was created in 2001 to invest $100 million in life science companies in three regions across the state. Capital investment programs include seed and early-stage funding of up to $1 million in convertible debt or equity in companies with significant potential for commercial growth. Since the program's inception, the three Life Sciences Greenhouses have funded 254 projects, including investments in 140 early-stage companies. |
| **Texas** | The Texas Emerging Technology Fund (TETF) invests in multiple high-tech industries, but the largest single sector is biotechnology and life science. Commercialization awards can take the form of debt or equity investment, or a combination of the two. Debt investments generally carry an 8 percent interest rate, with a term of up to 10 years, or until a defined equity event occurs. From 2006 to 2011, the TETF invested in 65 life science companies, with total investments of more than $100 million. |

# *Relieve Tax Burden*

## *Extend and Expand the Qualified Business Venture Tax Credit*

### Recommended Appropriation: $15,000,000 (Recurring) (Currently $7,500,000)

**OVERVIEW:** Extend the Qualified Business Venture Tax Credit, which is scheduled to expire December 31, 2013. Increase the rate of the credit from 25 percent to 50 percent and the maximum credit amount to $100,000. Increase the statewide limit on all credits from $7.5 to $15 million.

**STATES WITH SIMILAR PROGRAMS:** Arizona, Arkansas, Connecticut, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Nebraska, New Mexico, New York, North Dakota, Ohio, Oklahoma, Rhode Island, Virginia, Wisconsin.

**RATIONALE:** Access to early-stage equity capital is one of the most challenging problems facing life science start-up companies in North Carolina. The most recent recession, combined with ever-lengthening product development cycles have severely eroded angel investment levels since 2010. A more aggressive tax credit structure is needed to reenergize life science angel investing in North Carolina. Twenty-two other states now offer similar credits, five with rates of 50 percent or higher.

The Qualified Business Venture Tax Credit gives high-wealth individuals an incentive to invest in technology-driven start-up companies. Although the credit is not limited to life science companies, most life science entrepreneurs say that it is a critical asset in securing funding from angel investors.

**DISCUSSION:** The QBV Tax Credit provides a 25 percent credit against personal income tax for individual investments in qualifying small businesses. Credits are capped at $50,000 per individual investor per year. To qualify for the credit, businesses must have less than $5 million in revenues annually and be engaged primarily in manufacturing, processing, warehousing, wholesaling, or research and development. In 2010, QBV companies raised $29.4 million in equity investments and claimed $5.1 million in credits. The QBV credit is currently scheduled to sunset December 31, 2013.

The QBV credit effectively stimulates angel and other early-stage investments that are critical to moving new technologies from universities and other research laboratories to commercialization and, ultimately, to profitability. The credit has become especially important in recent years as venture capital funds have shifted emphasis to later-stage start-up companies. The resulting void in funding opportunities is often called the “valley of death” for entrepreneurs launching new businesses.

A study completed by NCBIO in 2007 showed that between 1989 and 2006, investors using the state’s Qualified Business Venture Tax credit claimed approximately $115 million in credits and generated nearly $545 million in capital contributions to qualifying small companies. Follow-on investments by venture funds during the same period brought total investments in QBV companies to $1.7 billion.

# *QBV: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **Arizona**<br>Rate – 35%<br>Investor Cap – $250,000<br>State Cap – $20,000,000 (multi-year) | Tax credit for investments in qualified bioscience and other small businesses. Credit amount is 35 percent for bioscience or rural company, 30 percent for other companies. Unused credits may be carried forward for up to three years. Up to $20 million in tax credits beginning July 1, 2006 through June 30, 2016. Authorized first-come-first-serve, based on date and time investor files application. |
| **Arkansas**<br>Rate – 33%<br>Investor Cap – n/a<br>State Cap – $6,250,000 | Tax credit against income or premium tax for persons or companies investing in eligible businesses. Awards at discretion of the Director of Arkansas Economic Development Commission. Credit is 33 ⅓ percent of purchase price for equity interests; limited to 50 percent of tax liability after all other credits and reductions. Unused credits may be carried forward nine years. |
| **Connecticut**<br>Rate – 25%<br>Investor Cap – $250,000<br>State Cap – $6,000,000 | Credit against income tax for investments made in qualifying businesses. Investments must be at least $25,000. Credit equals 25 percent of the cash investment, up to a maximum credit of 250,000. |
| **Georgia**<br>Rate – 35%<br>Investor Cap – $50,000<br>State Cap – $10,000,000 (multi-year) | Credit against personal income tax for 35 percent of investment amount; available for investments made in 2011, 2012, and 2013. Credits can be used beginning in second year following the year of investment. Aggregate amount of credit allowed against taxable income for any number of qualified investments is $50,000 per taxpayer annually. |
| **Illinois**<br>Rate – 24%<br>Investor Cap – $500,000<br>State Cap – $10,000,000 | Tax credit of 25 percent for firms or natural person(s) investing in qualifying business venture. Maximum amount of investment used as basis for a credit is $2,000,000 for each investment. |
| **Indiana**<br>Rate – 20%<br>Investor Cap – $1,000,000<br>State Cap – $12,500,000 | Tax credit for individuals and corporations for investments in debt or equity of qualifying Indiana companies. |
| **Kansas**<br>Rate – 50%<br>Investor Cap – $50,000<br>State Cap – $6,000,000 | Tax credit for 50 percent for investments in qualifying companies. |
| **Kentucky**<br>Rate – 40%<br>Investor Cap – n/a<br>State Cap – $80,000,000 | Tax credit of 40 percent for personal and corporate investors in approved investment funds. Credits are allocated to funds, then granted proportionately to funds' investors. Kentucky Economic Development Finance Authority allocates the credits to investment funds. |

| STATE | SUMMARY |
|---|---|
| **Louisiana**<br>Rate – 35%<br>Investor Cap – None<br>State Cap – $4,000,000 | Credit against personal income or corporate franchise for 35 percent of investments in certified Louisiana Entrepreneurial Businesses. Total tax credits cannot exceed $5 million. |
| **Maine**<br>Rate – 60%<br>Investor Cap – $300,000<br>State Cap – None | Tax credit of up to 60 percent for investors in eligible Maine businesses. Investments may be used for fixed assets, research or working capital. |
| **Maryland**<br>Rate – 50%<br>Investor Cap – $250,000<br>State Cap – $6,000,000 | Credit against income tax for 50 percent of eligible investments in qualified Maryland biotechnology companies. Maximum credit amount is $250,000. Total credit certificates issued in a fiscal year cannot exceed budget amount. Applications reviewed and approved on a first come basis. |
| **Michigan**<br>Rate – 25%<br>Investor Cap – $250,000<br>State Cap – $9,000,000 | Tax credit of 25 percent for individual investors, companies, and limited partners in venture capital funds. |
| **Minnesota**<br>Rate – 25%<br>Investor Cap – $125,000<br>State Cap – $12,000,000 | Tax credit for individuals or investment funds for investments in startup and emerging companies focused on high technology or new proprietary technology. |
| **Nebraska**<br>Rate – 35%<br>Investor Cap – $300,000<br>State Cap – $3,000,000 | Tax credit for 35 percent of investments in qualifying small businesses. Investments in certain economically distressed areas may be eligible for a refundable tax credit equal to 40 percent. Maximum annual credit of $350,000 for married couples filing jointly and $300,000 for all other filers. |
| **New Mexico**<br>Rate – 25%<br>Investor Cap – $25,000<br>State Cap – $75,000,000 | Tax credit for 25 percent of qualifying investment in a high-technology or manufacturing business. Maximum investment of $100,000. Maximum of two qualifying investments per investor annually, provided that each investment is in a different qualified business. Unused credits may be carried forward for three years. |
| **New York**<br>Rate – 20%<br>Investor Cap – $300,000<br>State Cap – None | Credit against personal income tax for 20 percent of investments in qualifying companies. |
| **North Dakota**<br>Rate – 45%<br>Investor Cap – $200,000<br>State Cap – $3,500,000 | Tax credit of 25 percent for individual, estate, trust, partnership, corporation, or limited liability company for investments in a qualified business. No more than $112,500 of the credit may be used in any year. Unused credits may be carried forward four tax years. Only the first $500,000 of eligible investments in the business are eligible for the tax credit. Total amount of credits for investments in any calendar year is limited to $3.5 million. |

| STATE | SUMMARY |
|---|---|
| **Ohio**<br>Rate – 25%<br>Investor Cap – $62,500<br>State Cap – $45,000,000 (multi-year) | Tax credit for 25 percent of investments in qualified, technology-based Ohio companies. |
| **Oklahoma**<br>Rate – 20%<br>Investor Cap – None<br>State Cap – None | Credit against various taxes for investments in small business capital companies, provided the investments are reinvested in qualifying small businesses. |
| **Rhode Island**<br>Rate – 50%<br>Investor Cap – $100,000<br>State Cap – $2,000,000 | Tax credit of 50 percent for eligible investments, with a maximum tax credit of $100,000. |
| **Virginia**<br>Rate – 50%<br>Investor Cap – $50,000<br>State Cap – $3,000,000 | Tax credit of 50 percent for individual and fiduciary taxpayers for investments in "equity" or "subordinated debt" of qualified small business ventures. Credits may not exceed the credit authorized by the Department of Taxation, $50,000, or the income tax liability on that year's return, whichever is less. The credit is nonrefundable. Unused credits may be carried forward up to 15 years. Per year statewide maximum of $3 million. |
| **Wisconsin**<br>Rate – 25%<br>Investor Cap – $500,000<br>State Cap – $47,500,000 (multi-year) | Tax credit for 25 percent of investments in qualifying companies. Maximum credit-eligible investments of $8 million per company. Maximum for all credits In all tax years is $47,500,000. |

# *Relieve Tax Burden*

## *Create Capital Gains Tax Credit*

### **Recommended Appropriation:** No appropriation; fiscal impact to be determined.

**OVERVIEW:** Exclude all or a portion of capital gains from state taxable personal income. Alternatively, establish a lower state personal income tax rate for capital gains. Relief can be made broadly applicable, or targeted to investments in North Carolina or innovation-based companies.

**STATES WITH SIMILAR PROGRAMS:** Arkansas, Iowa, Montana, Nebraska, New Hampshire, New Mexico, North Dakota, Oklahoma, South Carolina, Tennessee, Utah, Vermont, Wisconsin. In addition, the following states impose no tax on any form of personal income: Alaska, Florida, Nevada, South Dakota, Texas, Washington and Wyoming.

**RATIONALE:** North Carolina's life science community depends heavily on capital investment; yet our state trails other major life science states in access to capital. By lowering the personal income tax rate on capital gains, North Carolina would encourage individuals to invest in growing companies, remove or reduce the current tax code's incentive for successful investors to leave the state, and dampen the impact of economic cycles on state tax collections.

**DISCUSSION:** Nineteen states impose no tax or reduced taxes on capital gains earned by individuals. Since 2003, the federal government has capped the capital gains rate for individuals at 15 percent—less than half the top marginal rate for ordinary income. These policies encourage individuals to invest savings and discretionary income in growing companies that will create new jobs in the economy.

North Carolina currently taxes capital gains at the same rate as ordinary income—thereby providing no incentive for individuals to invest in growing our economy. In fact, by taxing capital gains at a rate higher than many surrounding states, North Carolina actually encourages investors to relocate to lower tax jurisdictions whenever successful investments mature. In addition, because capital gains often increase during periods of economic expansion (and decrease during economic downturns), North Carolina's high capital gains tax rate amplifies peaks and troughs in state revenues associated with cycles of the economy.

Capital gains tax relief can be implemented narrowly or broadly. Many states, for example, target capital gains tax reductions to investments in in-state companies. Capital gains tax relief can encourage "patient" capital (as opposed to more speculative trading of assets) by targeting reductions to longer term investments.

North Carolina ranks 14th in the nation in venture capital investments as a percentage of gross state product. In absolute dollars, North Carolina companies receive one-twentieth the amount of venture capital investments as California, the nation's top venture investment location.

Properly structured capital gains tax relief can be expected to materially improve life science companies' access capital in North Carolina. Capital gains tax reductions would be particularly meaningful to our life science sector if targeted to long-term investments in in-state companies. Targeted capital gains tax relief could be implemented with less impact on state revenue collections.

# *Capital Gains Tax: State Program Summary*

## *Income Tax Rate*

| STATE | SUMMARY |
|---|---|
| **Alaska**<br>Rate – 0 % | No personal income tax |
| **Arkansas**<br>Rate – 7 % | Exclusion from personal income tax for 100 percent of net capital gains from venture capital investments held in Arkansas companies held for at least five years. Exclusion for 30 percent of other net capital gains on investments held for more than 12 months. |
| **Florida**<br>Rate – 0 % | No personal income tax |
| **Iowa**<br>Rate – 8.98 % | Exclusion from individual income tax for 100 percent net capital gains on sale of substantially all of the assets of business, including stock sales treated as asset sales, held by an owner who has materially participated in the business for at least 10 years. |
| **Montana**<br>Rate – 6.9 % | Exclusion from personal and corporate income tax for 100 percent of net capital gains on investments in federally qualifying Small Business Investment Corporations |
| **Nebraska**<br>Rate – 6.84 % | Once-in-a-lifetime exclusion from personal income tax for 100 percent of net capital gains from sale of stock in a corporation acquired because of employment at company doing business in Nebraska for at least three years. |
| **Nevada**<br>Rate – 0 % | No personal or corporate income tax |
| **New Hampshire**<br>Rate – 5 % | Personal income tax applies to dividends and interest only. |
| **New Mexico**<br>Rate – 4.9 % | Exclusion from personal income tax for the greater of 50 percent or $1,000 of net capital gains. |
| **North Dakota**<br>Rate – 3.9 % | Exclusion from personal income tax for 30 percent of net capital gains on investments held for one year or more |
| **Oklahoma**<br>Rate – 5.25 % | Exclusion from personal and corporate income tax for net gains from sale of stock ownership interest in an Oklahoma-headquartered company, limited liability company, or partnership if the stock or interest was owned for at least two uninterrupted years prior to sale |
| **South Carolina**<br>Rate – 7 % | Exclusion from personal income tax for 44 percent of net capital gains on investments held for two years or more |

| STATE | SUMMARY |
|---|---|
| **South Dakota**<br>Rate – 0 % | No personal or corporate income tax |
| **Tennessee**<br>Rate – 6 % | Personal income tax applies to dividends and interest only. |
| **Texas**<br>Rate – 0 % | No personal or corporate income tax |
| **Utah**<br>Rate – 5 % | Credit against personal income tax for 5 percent of net capital gains if 70 percent are reinvested in qualifying Utah small business |
| **Vermont**<br>Rate – 8.95 % | Exclusion from personal income tax for 40 percent of net capital gains from the sale of non-publicly traded stocks held for three years or more |
| **Washington**<br>Rate – 0 % | No personal or corporate income tax |
| **Wisconsin**<br>Rate – 6.75 % | Exclusions from personal income tax for: (1) 30 percent of net capital gains on investments held for one year or more; (2) 100 percent of net capital gains on investments in qualifying small businesses held for five years or more; deferral of personal income tax on 100 percent of long term capital gains reinvested in qualifying Wisconsin business |
| **Wyoming**<br>Rate – 0 % | No personal or corporate income tax |

# *Relieve Tax Burden*

## *Exempt R&D Supplies from Sales Tax*

### **Recommended Appropriation:** No appropriation; fiscal impact to be determined.

**OVERVIEW:** Exclude supplies used in scientific research and development activities from state sales and use tax.

**STATES WITH SIMILAR PROGRAMS:** Colorado, Connecticut, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, Pennsylvania, Vermont, Virginia, West Virginia, Wisconsin. In addition, the following states impose no sales tax: Alaska, Delaware, Montana, New Hampshire and Oregon.

**RATIONALE:** R&D supplies are inputs to the development of new products. These supplies should be afforded the same tax treatment as manufacturing inputs. Small life science companies, which typically have no income tax liability, do not benefit from the corporate income tax credit for research and development spending. A sales tax exemption would improve tax parity for large and small research companies and encourage more robust research and development activity with the state.

**DISCUSSION:** Innovation leads to new products and more robust economic activity. Preservation of any economy's manufacturing base depends on the regular and systematic development of new manufactured products and the improvement of existing products. Research and development are the source of these product innovations. Prudent tax policy therefore seeks to stimulate research and innovation to at least the same degree as manufacturing.

North Carolina currently imposes sales tax on research and development supplies. While some of this tax burden is offset by the state's existing credit against corporate income tax for R&D spending, the corporate tax credit is not meaningful to early-stage life science companies (which usually have no profits, and therefore pay no tax). The state's existing sales and use tax structure offers all companies a very favorable tax rate (the lesser of 1 percent or $80 per item) on purchases of research and development equipment, but this rate does not apply to items other goods used or consumed in the research and development process. Although North Carolina offers certain companies a 50 percent sales tax refund for medical testing supplies, this benefit does not reach most life science research companies.

Most research-intensive life science companies incur substantial sales and use tax liability for purchases of R&D supplies. Exempting these supplies from sales tax would remove a key existing tax burden from North Carolina research and development companies. Elimination of the sales and use tax on R&D supplies would also encourage the relocation of out-of-state research and development companies to North Carolina.

Eighteen states currently impose no sales and use tax or reduced sales and use tax on purchases of R&D supplies. Several of these states, including Massachusetts, New Jersey, Pennsylvania and Virginia are among the nation's top life science states. North Carolina can materially improve its competitive position as a location for life science research and development by excluding R&D supplies from sales and use tax.

# *R&D Sales Tax Relief: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **Alaska**<br>Rate – 0 % | No sales tax. |
| **Colorado**<br>Rate – 2.90% | Refund of sales tax on tangible personal property, including machinery a, used in Colorado directly and predominantly for research and development or in a combined activity of research and development and manufacturing; subject to availability of funds from state revenue surplus. |
| **Connecticut**<br>Rate – 6.35% | Exemption for machinery, equipment, tools, materials, supplies and fuel used directly in the biotechnology industry.<br><br>Note: Biotechnology means the application of technologies, such as recombinant DNA techniques, biochemistry, molecular and cellular biology, genetics and genetic engineering, biological cell fusion techniques, and new bioprocesses, using living organisms, or parts of organisms, to produce or modify products, to improve plants or animals, to identify targets for small molecule pharmaceutical development, to transform biological systems into useful processes and products or to develop microorganisms for specific uses. |
| **Delaware**<br>Rate – 0 % | No sales tax. |
| **Maryland**<br>Rate – 6 % | Sales tax does not apply to purchases of tangible personal property for use or consumption in research and development. Research and development means basic and applied research in the sciences and engineering and the design, development and governmentally mandated pre-market testing of prototypes and processes.<br><br>Note: Exemption does not include market research, research in the social sciences or psychology, and other nontechnical activities, routine product testing, sales services or technical and nontechnical services are not included in the exemption. |
| **Massachusetts**<br>Rate – 6.25% | Sales tax does not apply to purchases of tangible personal property used directly and exclusively in research and development.<br><br>Note: Share of entity receipts or expenditures for research and development in Massachusetts must meet minimum threshold. |
| **Michigan**<br>Rate – 6 % | Exemption for tangible personal property used by an industrial processor in research and development. |
| **Missouri**<br>Rate – 4.225% | Exemption for tangible personal property and utilities purchased for use or consumption directly or exclusively in the research and development of agricultural/biotechnology and plant genomics products and prescription pharmaceuticals consumed by humans or animals.= |
| **Montana**<br>Rate – 0 % | No sales tax. |

| STATE | SUMMARY |
|---|---|
| **New Hampshire**<br>Rate – 0 % | No sales tax |
| **New Jersey**<br>Rate – 7 % | Exemption for tangible personal property, except energy, and specified digital products purchased for use or consumption directly and exclusively in research and development in the experimental or laboratory sense Such research and development shall not be deemed to include the ordinary testing or inspection of materials or products for quality control, efficiency surveys, management studies, consumer surveys, advertising, promotions or research in connection with literary, historical or similar projects.<br><br>Note: Does not include ordinary testing or inspection of materials or products for quality control, efficiency surveys, management studies, consumer surveys, advertising, promotions or research in connection with literary, historical or similar projects. |
| **New York**<br>Rate – 7 % | Exemption for tangible personal property purchased for use or consumption directly and predominantly in research and development in the experimental or laboratory sense.<br><br>Note: Exemption does not include ordinary testing or inspection of materials or products for quality control, management studies, consumer surveys, etc. |
| **Oregon**<br>Rate – 0% | No sales tax. |
| **Pennsylvania**<br>Rate – 6 % | Exemption for tangible personal property and services to be used directly in research having as its objective the production of a new or improved product or utility service or method of producing a product or utility service, but in either case not including market research or research having as its objective the improvement of administrative efficiency. The exemption also applies to taxpayers who undertake research under contract for exempt purposes. |
| **Vermont**<br>Rate – 6 % | Exemption for tangible personal property purchased for use or consumption directly and exclusively, except for isolated or occasional uses, in commercial, industrial or agricultural research or development in the experimental or laboratory sense.<br><br>Note: It shall be rebuttably presumed that uses are not isolated or occasional if they total more than four percent of the time the machinery or equipment is operated. Such research or development shall not be deemed to include the ordinary testing or inspection of materials or products for quality control, efficiency surveys, management studies, consumer surveys, advertising, promotions, or research in connection with literary, historical or similar projects. |
| **Virginia**<br>Rate – 5 % | Exemption for tangible personal property purchased for use or consumption directly and exclusively in basic research or research and development in the experimental or laboratory sense. |
| **West Virginia**<br>Rate – 6.50 % | Exemption for tangible personal property used or consumed in the activity of research and development. |
| **Wisconsin**<br>Rate – 5 % | Exemption for tangible personal property sold to persons who are engaged primarily biotechnology in Wisconsin, if the tangible personal is consumed or destroyed or loses its identity while being used exclusively and directly in qualified research. |

# *Initiate Life Science Site and Infrastructure Readiness Program*

## Recommended Appropriation: $10 million – $25 million (Non-recurring)

**OVERVIEW:** Initiate a program to support infrastructure enhancements specific to life-science company relocation and expansion projects. The capacity to make infrastructure improvements that impact designated life-science sites will increase North Carolina's competitiveness for these projects.

**STATES WITH SIMILAR PROGRAMS:** Maryland, Nebraska, New York and Ohio.

**RATIONALE:** When companies decide to expand, the project timeline is often short. Companies conduct a national or international search for appropriate sites. They evaluate a range of factors from workforce to business climate to the site itself. A biomanufacturing operation needs significant water availability, special wastewater treatment capabilities and other robust utility requirements. Given the importance of the life sciences as a target industry sector for North Carolina, the state's current position as a leader in life science manufacturing, and the increasing investment on the part of national and international competitors to offer "shovel-ready" sites in this space, North Carolina would benefit from a site readiness program that brings these enhancements to sites of interest. These investments will enhance the sites' competitiveness and shorten timelines for facility construction, making the state more competitive for these projects.

**DISCUSSION:** North Carolina is a global leader in biomanufacturing and often competes for larger-scale projects that create hundreds of higher-than-average-wage jobs and attract millions of dollars of investment. This sector was one of the few in the state that added jobs during the recent economic downturn and continues to provide North Carolina with opportunities for future job growth. With jobs paying an average of $78,000, many states compete for these projects. North Carolina does not always win.

In two cases a proactive life science readiness program would have benefited North Carolina. A $300 million Bristol Myers Squibb monoclonal antibody manufacturing project went to Massachusetts. A $1.2 billion Baxter plasma biotherapeutics manufacturing project chose Georgia.

The identification and prioritization of life science sites will involve an analysis of labor, workforce training, supply chain and other community/regional assets that support a given site as preferred for the targeted infrastructure enhancement funding. Accompanying the selection of preferred sites will be a community-readiness process that will bring together the appropriate community agencies and organizations to increase their familiarity with the unique requirements of life science projects. The state can then market both the site and the supporting community assets.

Existing company expansion is also a significant driver of new job growth. Often multiple domestic or global operations within a company will compete internally for expansion projects. This program will provide the capacity to also support infrastructure improvements that impact sites of existing companies, making them more competitive in retaining and expanding jobs and investment.

# *Site Readiness: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **Maryland** | The Maryland Economic Development Assistance Authority and Fund (MEDAAF) offers a specific program: Direct Assistance to Local Jurisdictions or MEDCO, which provides financial assistance to a local jurisdiction for local economic-development needs. MEDAAF was originally approved by the Maryland General Assembly in 1999 as a non-lapsing revolving loan fund to provide below-market, fixed-rate financing to growth-industry businesses, locating or expanding in priority funding areas of the State. This new economic development program is directed by the Department of Business and Economic Development.[1] Funds can be used for land acquisition, infrastructure improvements, acquisition of fixed assets, leasehold improvements, up to 70 percent of the cost of a feasibility study, and up to 50 percent of the cost of preparing a local economic development strategic plan.[2] |
| **Nebraska** | The four-part Talent and Innovation Initiative was created to support Nebraska's fastest-growing industry and others that may utilize advanced technologies. The initiative includes a Site and Building Development Fund (SBDF), intended to increase commercial sites available and ready for business development. Communities provide matching funds toward projects that can involve land and building acquisition; building construction or rehabilitation; site preparation; infrastructure development and improvements; engineering and design costs; technical assistance and planning; and other pre approved costs necessary for the development of industry-ready sites and buildings. State funding is available to local governments or non-profits for land and infrastructure costs, with 40 percent of the funding available to non-metro areas. From October 3, 2011 to June 30, 2013 the Department of Economic Development intends to invest in at least four sites or buildings with the SBDF.[3] |
| **New York** | The Southern Tier Regional Infrastructure Fund for Shovel Ready Sites Program was created in 2011 when the Southern Tier Regional Economic Development Council was awarded $2.5 million by New York State. This fund provides gap financing in the form of loans to municipalities, municipal authorities, economic development organizations and chambers of commerce. The goals of the fund include enabling the region to quickly respond to development opportunities and enhance the marketability of shovel-ready sites. Three development types are being targeted with this program in New York: high-tech manufacturing sites, distribution/logistics/E-commerce sites and multi-tenant business and technology parks.[4] |
| **Ohio** | The Ohio Job Ready Sites Program strategically grants funds to offset costs typically incurred in speculative commercial and industrial development. Projects receiving funds must also satisfy extensive industry standards to receive certification. This program is funded through $150 million in bonds sold by the state over a seven-year period. During fiscal year 2012, the program's fourth funding round since 2006, 10 out of 30 applications were granted funding, totaling $10 million.[5]<br><br>One focus of the program is on tech center/research labs. In 2007, the city of Reading was awarded $2.3 million to develop a 13.8-acre site specifically for life science companies. The property formerly housed a glass and box manufacturing plant, and is contiguous to the Reading Life Science Complex, one of the largest biotechnology centers in the Midwest. The currently certified and developed site can now accommodate a $50 million building with 100,000 square feet of laboratory and office space, which in turn would generate 300 to 400 new research and support jobs with an annual payroll of $15 million to 20 million.[6] |

1 Maryland Economic Development Assistance Authority and Fund (MEDAAF) "Annual Financial Status Report Fiscal Year 2011". June 30, 2011, *www.choosemaryland.org/aboutdbed/Documents/ProgramReports/2011/MEDAAFAnnualReportFY11.pdf*
2 Business Resources, *www.choosemaryland.org/businessresources/pages/medaaf.aspx*
3 Site & Building Development Fund, *www.neded.org/business/talent-a-innovation-initiative/site-and-building-development-fund*
4 Guidelines for Southern Tier Regional Infrastructure Fund for Shovel Ready Sites, 2012, *regionalcouncils.ny.gov/assets/documents/southerntier/InfrastructureFundforShovelReadySites2012Guidelines.pdf*
5 Redevelopment: Job Ready Sites, *www.development.ohio.gov/redev/JRS_funding.htm*
6 Reading Life Science Campus Expansion Project Summary, *www.readingohio.org/docs/ReadingLifeSciencesCampusExpansionSiteProjectSummary.pdf*

# *Create Incubator Facilities for Startup Companies*

## Recommended Appropriation: $500,000 (Non-recurring)

**OVERVIEW:** Fund incubator and accelerator space, which is critical for startup companies. This recommendation includes dollars to upfit facilities and purchase equipment. Increasing the inventory of wet-lab, greenhouse and related space for young companies accelerates the progress of technology from university and private research institutions into job-creating companies.

**STATES WITH SIMILAR PROGRAMS:** Alabama, Georgia, Kansas, Maryland, Massachusetts, Michigan, Missouri, New Jersey, Pennsylvania, Texas

**RATIONALE:** Start-up life science companies often struggle to find affordable lab space. Incubators can provide access to cost-effective space as well as flexible lease terms that appeal to cash-strapped start-ups. These facilities/programs often offer shared resources that minimize cost, as well as professional and scientific services (e.g., legal, business development, financing, etc.) that benefit tenants. North Carolina would benefit from the presence of more incubator/accelerator space to more effectively leverage the strong base of technology with commercial potential resident in North Carolina universities and research institutions.

**DISCUSSION:** Access to low-cost, flexible wet-lab and related space enables commercialization by providing a location for entrepreneurs to develop technology into products and services. In the life sciences, access to this type of space is often through incubator and accelerator facilities associated with, or near, research centers such as universities or private research institutions. Entrepreneurial faculty often seek off-campus space to segregate the new company from the university or research institution for conflict-of-interest, funding or other reasons. Still, they require easy access. Entrepreneurs also need cost-competitive space with flexible size and lease terms. Additional amenities like shared equipment and access to support services is also a benefit. Some regions provide these ancillary services virtually through networks and organizations, which can support companies if adequately priced and equipped space is available. Affordable access to unique and scarce facilities, such as greenhouse space, is also beneficial.

North Carolina is home to a rich constellation of university and private research institutions that act as a source of technology for new company creation. Not as abundant are the facility resources to accommodate new and emerging life science ventures. The state would benefit from a program that provided funding support to existing incubators, accelerators, research parks, and related commercial real estate offerings as well as aid in the development of new facilities that support start-ups and emerging companies. It is often relatively inexpensive to reconfigure or upfit existing space for this purpose in comparison to the cost of building new wet-lab space. For example, Park Research Center is located in Research Triangle Park and is home to a number of small start-up life science companies. The converted 75,000 square foot, thirteen building campus offers both office and lab space for lease on flexible, cost-efficient terms. Improvements to a set of labs including modifications that would create 10 new operational wet labs can be accomplished for an estimated $250K and have a significant impact of the inventory of available space for new and relocated life science companies in the Triangle region.

The Park Research Center example can be replicated across North Carolina to expand the availability of cost-competitive wet-lab and related space and fill a gap in the state's innovation/commercialization infrastructure. The Biotechnology Center is also exploring a public-private partnership to provide affordable access to hard-to-find greenhouse space that would benefit from this program and accelerate the creation, growth and attraction of innovative ag biotech companies.

# *Incubator Facilities: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **Alabama** | Innovation Depot is a public-private business incubation facility of 140,000 square feet focused on biotechnology, life science, information technology, and service businesses which operates in partnership with the University of Alabama (UAB). The facility is funded by the Birmingham regional business community, the Community Foundation of Greater Birmingham and other leading private foundations, UAB, the City of Birmingham and Jefferson County. Nine biotech/life science companies are currently housed in this incubator.[1] |
| **Georgia** | The Georgia Health Sciences University Business Incubator and Life Sciences Business Development Center's 16,000 square feet of space can hold up to five entrepreneurial businesses in the life sciences. This incubator is located on GHSU's main campus in Augusta, and was initially created by the Center of Innovation for Life Sciences with funding from OneGeorgia Authority, which in turn is funded by one-third of Georgia's Master Tobacco Settlement.[2] |
| **Kansas** | The Kansas Venture Accelerator is a 39,000-square-foot facility in the Kansas Bioscience Park in Olathe, designed specifically for emerging bioscience companies. Clients can partake in lab and/or office space, as well as advice from local bioscience expertise. Adjacent acreage is available at no-cost to qualifying bioscience organizations looking to build their own facilities. The Venture Accelerator was built with state funds, approximately $19 million from the Kansas Bioscience Authority, and opened in May 2011.[3] |
| **Maryland** | Maryland has implemented several programs, several based on ideas borrowed from North Carolina. The Maryland Technology Development Corporation runs programs to promote technology transfer from research universities and federal labs. Programs include an Incubator Development Fund, which provides matching funds for capital development, not operations. The University of Maryland Technology Advancement Program supports advanced-technology companies by providing space and professional staff to support the entrepreneurial companies. The BioInnovation Center holds lab and office space in the University of Maryland's BioPark. |
| **Massachusetts** | Massachusetts Biomedical Initiatives is a private economic development organization that manages three incubator facilities in Worcester. These incubators have an 85 percent occupancy rate, and as of February 2012, half of revenue is generated from rents, 15 percent from state subsidy, and 35 percent from licensing fees and interest income. Over the past 10 years, 59 life science companies have "graduated" from these incubators, with 75 percent successfully operating in 2012, and with 86 percent of those still located in Massachusetts.[7] |
| **Michigan** | Located in Plymouth, the Michigan Life Science and Innovation Center is specifically designed for life science research and business development; it includes a 57,000-square-foot life science incubator, complete with laboratory, office and conference space. Partners in the venture include the Michigan Economic Development Corporation; Wayne County; a private foundation; Ann Arbor SPARK; the New Economy Initiative; and Plymouth Township.[8] |

1 Innovation Depot, *www.innovationdepot.net*
2 GHSU Business Incubator and Life Science Business Development Center, *www.georgiahealth.edu/incubator*
3 Incubator space, *www.kansasbioauthority.org/incubator-space*
4 TEDCO, *www.marylandtedco.org/tedcoprograms/incubatordevelopmentfund.cfm*
5 MTech: Technology Advancement Program, *www.tap.umd.edu*
6 Our Properties, *www.umbiopark.com/our-properties/bioinnovation-center*
7 Massachusetts Biomedical Initiatives, *massbiomed.org*
8 Michigan Life Science and Innovation Center Life Science Incubator, *www.annarborusa.org/business-accelerator/incubators/michigan-life-science-innovation-center*

| STATE | SUMMARY |
|---|---|
| **Missouri** | The Missouri University Life Science Business Incubator is located on the University of Missouri campus, and opened in 2009. Wet labs, dry labs and offices are all available. The incubator is operated by the Missouri Innovation Center, a public, non-profit organization. This Center receives funding from the Missouri Technology Corporation, the Trulaske College of Business, miscellaneous grants, fees earned for services, and rental income. The incubator is intended for ventures formed by University of Missouri students or staff, entrepreneurs in the mid-Missouri community, or entrepreneurs focused on a high tech industrial venture.[9] |
| **New Jersey** | The Science Incubator at Burlington County College Mount Laurel Campus offers eleven wet labs in a 12,800-square-foot facility specifically created for clients working in the life sciences. Other services include entrepreneurial workshops, trainings, seminars as well as general access to local bioscience expertise. Current clients include Lipogen LLC, Illumination Machines, and American CryoStem Corporation. The $4 million Science Incubator opened in 2007 and was initially supported in large part by Burlington County College, but also by grants from The New Jersey Commission on Science and Technology totaling approximately $1.2 million.[10] |
| **Pennsylvania** | The Ben Franklin TechVentures high-tech workspace for early-stage companies is located on the campus of Lehigh University in Bethlehem, Pennsylvania. This 109,000-square-foot facility contains wet lab, conference and office space. Successful "graduates" of the incubator include CICLON/Texas Instruments, IQE, and Saladax Biomedical.[11] |
| **Texas** | The Texas Life Sciences Collaboration Center (TLCC) is a non-profit in Georgetown with a mission to bring post-incubation companies to the area. The TLCC was founded in 2007 with grants and support from City of Georgetown, Southwestern University, the Georgetown Independent School District, and the Georgetown Chamber of Commerce. Initial space for the Center was donated—a new 15,000-square-foot Class I commercial building with wet lab, nanotechnology clean room, teaching laboratory, and office space. The TLCC has future expansion plans to create a complex that includes medical device research space and manufacturing facilities.[12] |

9 Life Science Business Incubator at Monsanto Place, *muincubator.com*
10 Science Incubator at BCC, *incubators.bcc.edu/pages/177.asp*
11 Ben Franklin TechVentures, *nep.benfranklin.org/incubator-network/ben-franklin-techventures*
12 Texas Life Sciences Collaboration Center, *www.texaslifesciences.com*

# *Establish Funding for Small-Company Attraction, Expansion and Retention*

## Recommended Appropriation: $1,000,000 (Recurring)

**OVERVIEW:** Expand funding for the Biotechnology Center's performance-based job creation grant program by $1,000,000 annually. This directly facilitates job creation by attracting, expanding and retaining more early- and mid-stage life-science companies.

**RATIONALE:** Biotechnology products have a long process to get to market. Along the way, a biotechnology company has to invest in different types of specialized equipment as it navigates each stage of development. Because small biotechs are often in a "pre-revenue" state, cost-effective mechanisms to fund expansions are critical. Often, these equipment purchases occur at an inflection point in a company's growth.

Like early-stage startups, these mid-stage companies also struggle to secure funding. Investments can be too costly for venture firms and too risky for banks. Other states have turned this situation into an opportunity to lure biotech companies by providing equipment grants. On a smaller scale, the Biotechnology Center's Economic Development Award has been an effective tool to support the attraction, expansion and retention of early- and mid-stage companies. The companies commit to job-creation milestones in exchange for their grants.

**DISCUSSION:** The Biotechnology Center EDA provides performance-based grants to life science companies to up fit or expand space and/or purchase equipment. Grants are pegged to job creation or retention milestones, and they include claw-back provisions in case a company does not meet its performance targets. Existing or relocating life-science companies receive resources to expand facilities and support new job creation. More funding will translate to more jobs.

To date the Biotechnology Center has awarded three EDA grants totaling $250,000, which secured commitments to create 160 jobs. That equates to $1,563 in grants per job created. The Biotechnology Center estimates that these jobs can have a combined economic impact in North Carolina of $116 million annually. Overall, every $1 granted generates $463 in economic activity.

With $1 million in additional funding, the Biotech Center can support more in-state life science expansions and more aggressively pursue the attraction of out-of-state companies. Based on the success of the program to date, an annual $1 million appropriation would yield 500 to 600 jobs (new or retained) annually.

# *Attraction, Expansion, Retention: State Program Summary*

| STATES | SUMMARY |
|---|---|
| **Arizona** | The Arizona Innovation Accelerator Fund is an $18.2 million loan participation program funded through the U.S. Department of Treasury's State Small Business Credit Initiative and managed by the Arizona Commerce Authority. Its goal is to stimulate financing to small businesses and manufacturers, in collaboration with private finance partners, to foster business expansion and job creation in Arizona. The program ends December 2016. Loan proceeds are to be used for working capital, inventory, equipment purchase, and real property improvements, but cannot be used for refinancing of existing debt or outstanding debt payments.[1] |
| **Colorado** | The Colorado Bioscience Discovery Evaluation Grant Program (BDEGP) was created in 2006 by the Colorado General Assembly to grow the bioscience industry in the state. The goal was to stimulate jobs and create new bioscience companies based on promising discoveries made at the state's major research institutions. In 2011, the state added an additional $26 million and extended the BDEGP to 2018 – for a total grant program of $56 million.[2] One type of grant included in this program, the Commercialization Infrastructure Grant, supports partnership efforts between the bioscience industry and research institutions to build infrastructure that supports the commercialization of bioscience technologies in Colorado.[3] |
| **Connecticut** | The Connecticut BioScience Facilities Fund helps qualified firms build out wet laboratory and related space to propel Connecticut's bioscience industry. Since its inception in 1998, the program has committed more than $37 million translating into more than 350,000 square feet of lab and support space throughout the state, including 10,600 square feet of transitional wet laboratory space in New Haven's Science Park at Yale. Connecticut Innovations, the state's venture capital organization, manages this $46 million fund. |
| **Illinois** | The Large Business Development Program is designed to provide grants to businesses undertaking a major expansion or relocation project that will result in substantial private investment and the creation and/or retention of a large number of Illinois jobs. Funds available through the program may be used by large businesses for bondable business activities, including financing the purchase of land or buildings, building construction or renovation, and certain types of machinery and equipment. Grant eligibility and amounts are determined by the amount of investment and job creation or retention involved.[4] |
| **Massachusetts** | The Emerging Technology Fund, administered by MassDevelopment (the state's finance and development authority), supports high-tech expansion in Massachusetts by providing loans and guarantees up to $1 million[5] for technology-based manufacturing facilities and equipment. |
| **Michigan** | Pure Michigan Business Connect (PMBC) is a public-private initiative created in 2001 which combines the lending and support services of Michigan state agencies, national banks and energy industries. Valued around $3 billion, the program aims to grow startup and second-stage companies through lending commitments from banks and pledges from companies to increase purchasing from Michigan-based companies.[6] Additional components of the PMBC initiative include $100 million in economic-development incentives and $25 million for a new innovation and entrepreneurship program available through the Michigan Economic Development Corporation (MEDC). MEDC awarded $25 million in July 2011 to eight organizations to support entrepreneurs in launching and growing start-up companies throughout the state.[7] |

1 Arizona Competitiveness Package. *www.bullheadazeda.com/downloads/Incentives.pdf*
2 Headley, Todd. "Reinvestment in innovation proves positive." Fort Collins Coloradoan. June 16, 2011.
3 Bioscience Discovery Evaluation Grants, *www.advancecolorado.com/funding-incentives/financing/bioscience-discovery-evaluation-grants*
4 Large Business Development Program (LBDP), *www.advancecolorado.com/funding-incentives/financing/bioscience-discovery-evaluation-grants*
5 Emerging Technology Fund, *www.massdevelopment.com/financing/specialty-loan-programs/emerging-technology-fund/*
6 Pure Michigan Business Connect, *www.massdevelopment.com/financing/specialty-loan-programs/emerging-technology-fund/*
7 "Tech-based Economic Development and the States: Legislative Action in 2011." SSTI. *www.ssti.org/Publications/tbedandstates2011.pd*

| STATES | SUMMARY |
|---|---|
| **Ohio** | The Innovation Ohio Loan Fund (IOLF), a program of the Ohio Third Frontier initiative, was created to assist existing Ohio companies develop next-generation products and services within certain targeted industry sectors. This is accomplished by financing the acquisition, construction, and related costs of technology, facilities, and equipment. Ohio's manufacturing sector is a key target of this program. The IOLF is intended to supply capital to Ohio companies having difficulty securing funds from conventional sources due to technical and commercial risk factors associated with the development of a new product or service. The IOLF can finance up to 75 percent of a project's allowable costs to a maximum of $2 million and a minimum of $500,000.[8] |
| **Pennsylvania** | Pennsylvania First is a grant, loan, and loan-guarantee funding tool used to increase investment and development of jobs in the Commonwealth. Businesses, or municipalities/authorities on behalf of a business locating or expanding in the locality or region, can receive funds which can be used for machinery/equipment; job training; infrastructure; land and building improvements; environmental assessment/remediation; acquisition of land, buildings and rights-of-way; working capital; and site preparation, demolition and clearance.[9] |
| **Texas** | The Texas Product/Business Fund provides asset-backed financing to companies doing business in Texas. Financing is done in the form of direct asset-based loans with competitive lending rates. Loans can be amortized up to the life of the asset. Texas companies or out-of-state/international companies doing business in the state are eligible to apply. Businesses must have unencumbered assets that are available for collateral. Preference for funding is given to the state's defined industry clusters including, but not limited to: nanotechnology, biotechnology, biomedicine, renewable energy, agriculture and aerospace.[10] |

8 Ohio Third Frontier, *development.ohio.gov/bs_thirdfrontier/default.htm*
9 Pennsylvania First, *www.newpa.com/find-and-apply-for-funding/funding-and-program-finder/pennsylvania-first*
10 Financing, *www.texaswideopenforbusiness.com/incentives-financing/financing/product-fund.php*

# *Restore NCBioImpact Funding for Worker Training*

## Recommended Appropriation: $2.5 million – $3 million (Estimated, recurring).

**OVERVIEW:** Restore funding for the NCBioImpact worker training and education consortium to pre-recession levels.

**STATES WITH SIMILAR PROGRAMS:** California, Florida, Georgia, Indiana, Iowa, Maryland, Massachusetts, Michigan, Minnesota, Nebraska, New York, Texas, Utah, Wisconsin

**RATIONALE:** Life science companies, particularly manufacturers, are heavily dependent on access to skilled labor. North Carolina created one of the first and most robust dedicated life science training capabilities in the world. As other states and countries have invested to build comparable capabilities, North Carolina's program has experienced funding cuts due to reduced state revenues. North Carolina's stature as competitive location for life science manufacturing, research and development depends on adequate funding for its life science worker training programs.

**DISCUSSION:** The NCBioImpact consortium consists of: (i) the Golden LEAF Biomanufacturing Training and Education Center (BTEC) at North Carolina State University, which provides students and incumbent workers specialized education and hand-on experience with commercial-scale biomanufacturing systems; (ii) the Biomanufacturing Research Institute and Technology Enterprise (BRITE) at North Carolina Central University, which provides laboratory-supported undergraduate and graduate education in drug discovery and development; and (iii) the North Carolina Community College System's BioNetwork, which operates a statewide network of life science training assets, including a "capstone" training center at the BTEC. Collectively, the NCBioImpact facilities represent a capital investment of more than $75 million. NCBioImpact has been referenced by new and expanding life science manufacturing companies—including Biogen Idec, Eisai, Grifols, Merck, and Novartis—as a key factor in deciding to locate or expand in North Carolina. In addition, research-intensive North Carolina life science companies have benefited from NCBioImpact graduates whose training includes experience in modern laboratory facilities and state-of-the art testing and drug discovery technology. Unlike traditional economic incentive programs, NCBioImpact does not involve cash grants to expanding companies, but instead invests in the skills and capabilities of individual North Carolina workers—whose know-how comprises a durable human asset. In addition, training provided by the network evolves to keep pace with ever-advancing life science technologies.

Nominal operating funding for the NCBioImpact consortium is approximately $17 million annually. Although the legislature has mandated only around $300,000 in cuts to the network, management discretionary cuts required from the University of North Carolina and the North Carolina Community College System since FY 2008-09 have resulted in an estimated $2.5 million in actual funding reductions. While these cuts have been sustainable in the short term, NCBioImpact institutions have been forced to reduce staff and defer essential spending on equipment maintenance and modernization. A restoration to the nominal funding level of $17 million is needed to maintain the competitiveness of North Carolina's life science worker training capability.

# *Worker Training: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **California** | Founded in 1997, the Keck Institute of Applied Life Sciences, Claremont Colleges claims to be the only American graduate institution devoted solely to bioscience education and discovery (though NC Central University's BRITE program is also a graduate institution devoted solely to bioscience education and discovery). The Keck Institute gets its funding from tuition and fees, grants, private contracts, federal contracts, investments and other revenues. With assets of $67 million, the Institute received a $50 million grant from the W.M. Keck Foundation at its founding and plans to create a School of BioPharmacy.<br><br>The California Biotechnology Initiative – Community College Training Program has four regional centers that offer biotech skills training and education, biology research and bioscience manufacturing. |
| **Florida** | Florida Biologix is a state-of-the-art multi-product cGMP facility that opened in 2006. The organization operates a nonprofit contract manufacturing organization with European certification, which is an operating unit of the Center of Excellence for Regenerative Health Biotechnology. |
| **Georgia** | Established in 1994, the Center for Biotechnology and Drug Design at Georgia State University, encourages cooperation with the biotechnology industry. The organization has 45 faculty members conducting research and development in vaccines, diagnostics, protein engineering and drug design and synthesis.<br><br>The University of Georgia Biomedical and Health Sciences Institute offers a bioprocessing and biomanufacturing program, primarily for graduate education and research. |
| **Indiana** | The 20,000-square-foot Indiana Center for Life Sciences at Ivy Tech Community College in Bloomington opened in 2009 with four science labs, three classrooms, a 5,000-square-foot manufacturing suite and several offices. In addition, the Indiana Department of Workforce Development has awarded $3 million in grants for creation and delivery of programs addressing workforce preparation for life sciences careers. |
| **Iowa** | The Center for Biocatalysis and Bioprocessing at the University of Iowa in Coralville began cGMP manufacturing in 2007 in facilities for both process development and manufacturing. The organization provides cGMP fermentation and protein purification services for Phase 1 clinical trials. |
| **Maryland** | The University of Maryland's Institute for Bioscience and Biotechnology Research specializes in the development of cell culture-based biopharmaceutical products. The organization is part of the Biotechnology Research and Education program and a companion to the Bioprocess Scale-Up Facility in the Maryland Technology Enterprise Institute. The BioMaryland 2020 plan calls for $1.3 billion in structured investments. |

| STATE | SUMMARY |
|---|---|
| **Massachusetts** | Ground was broken in May 2012 for the $28 million Biomanufacturing Center at the University of Massachusetts at Dartmouth is a business accelerator designed to serve researchers and entrepreneurs on a fee-for-service basis as they develop products and methods in biotherapeutics, biomedicine and green chemistry. Funded through the Bioscience Industry Skill Development Program, which covers all workforce development activities including need identification, curriculum development, professional training, instructional equipment grants, online hosting and teacher mentoring. Funding included $10 million from University of Massachusetts, $14.6 million capital grant from the Massachusetts Life Sciences Center; $3 million in equipment grants and corporate donations; anticipated $1 million a year will be added for skills-development programming.<br><br>New in 2012, the $30 million Biomanufacturing and Training Center at Worcester Polytechnic is a 10,000-square-foot fully functional biomanufacturing pilot plant that provides hands-on training and education needed to produce medicines. Funding includes $5.1 million from Massachusetts Life Science Center and equipment donations from industry. |
| **Michigan** | Founded in 1981 and initially funded by state, federal and private foundation investments, the Michigan Biotechnology Institute in Lansing became a wholly owned subsidiary of the Michigan State University Foundation in 2005. The 25,000-square-foot facility includes bench-scale laboratories, a three-story, multi-bay fermentation and recovery pilot plant, as well as a state-of-the-art, computer-controlled utilities system for air, steam, waste and water handling. |
| **Minnesota** | The Biotechnology Institute at the University of Minnesota was renovated in 2010 to add a 500-liter fermenter, chiller system and centrifuge. |
| **Nebraska** | The Biological Process Development Facility at the University of Nebraska at Lincoln operates two fully functional cGMP pilot plants supported by quality control laboratories and a master cell banding suite. The facilities include 6,000 square feet of clean rooms and 7,000 square feet of support space. |
| **New York** | The Center for Bioscience Education and Technology at the Rochester Institute of Technology is 35,000 square feet. |
| **Texas** | The National Center for Therapeutics Manufacturing at Texas A&M University offers a 145,000-square-foot facility on the Texas A&M Health Science Center campus and includes a 104,000-square-foot bioprocessing wing with space for pods for vaccine production. The organization has a $285.6 million public-private partnership with the U.S. Department of Health and Human Services, as well as private businesses and the State of Texas. |
| **Utah** | The Center for Integrated BioSystems at Utah State University is a 30,000-square-foot facility with state-of-the-art equipment for use in genomics, proteomics, flow cytometry, fermentation and protein purification.<br><br>INNOVABio at Salt Lake City Community College is a contract research organization that creates flexible industry-based research and development opportunities to high school and college students. |
| **Wisconsin** | Funded by the National Institutes of Health, the University of Wisconsin's Madison Biotechnology Training Program helps students earn minor degrees with focus on cross-disciplinary training. |

# *Increase Teacher Development in Biotech Subjects*

## Recommended Appropriation: $500,000 (Recurring)

**OVERVIEW:** Provide professional development in biotech-related STEM disciplines for K-12 teachers. This recommendation enhances outreach to teachers statewide, including those at charter schools.

**STATES WITH SIMILAR PROGRAMS:** Most states now have initiatives to strengthen STEM education in general. State programs worth noting include Arizona, California, Florida, Georgia, Illinois, Indiana, Iowa, Maryland, Massachusetts, New York, Tennessee and Texas.

**RATIONALE:** Growing a well-educated and scientifically savvy workforce is an essential foundation for recruiting and growing new high-tech business in North Carolina. Yet most students and their parents are still unaware of all the career possibilities in biotechnology. Too many students leave school without getting excited about pursuing science and engineering careers. One of the most important factors contributing to effective teaching of science is teachers' mastery of science, yet strong concentrations in science are often not part of typical teacher education curricula. Therefore, professional development in STEM content related to biotechnology and good science pedagogy are critical needs.

**DISCUSSION:** NCBiotech is the state's primary source of professional development for teachers in biotechnology science, applications, and careers. The program includes hands-on laboratory practice, extensive teaching resources, and follow-up support available to teachers from all middle and high schools. NCBiotech has trained more than 1900 teachers during the last 25 years, and graduates reach more than 50,000 students per year. Nonetheless, we are still not reaching all the teachers that could benefit from this program. Expanded funding will enable more workshops across the state, particularly increasing access to charter schools. Specifically, increased state funding would:

- Expand the number of teachers served by NCBiotech professional development;
- Establish distance learning and other options for flexible delivery of professional development around the state;
- Create an outreach program to support biotech-related courses at charter schools
- Deploy teacher mentors to help new workshop graduates;
- Start a new grant program to encourage biotechnology-focused outreach projects by other educational organizations in the state.

# *Teacher Development: State Program Summary*

| STATE | SUMMARY |
|---|---|
| **Arizona** | The University of Arizona's College of Education's program, Math & Science Teacher Education/Retention Industry Partnerships creates middle- and high-school STEM teachers either through a Master's degree program or a professional continuing education program. The program gives in-service teachers paid summer internship opportunities in businesses to create a connection between the workforce and the classroom. Teachers bring their internship experiences back to students. |
| **California** | California STEM Learning Network (CSLNet) works with state/regional partners to produce a highly skilled K-12 STEM teaching workforce by providing professional development opportunities and increasing awareness and opportunities for students to pursue STEM teaching careers.<br><br>The California Department of Education maintains an internal Math & Science Partnership grant program, aimed at teacher development. (Funded at $22 million in the FY 2008–2009 budget.)<br><br>The University of California System also sponsors a centrally managed California Science Project, a professional development network for PK-16 teachers with sites across the state.<br><br>The Life Sciences Summer Institute Teacher Externship Program is hosted at Biogen Idec in its San Diego Community Laboratory facility and utilizes the Amgen-Bruce Wallace Biotechnology Laboratory Program curriculum. Participants receive free supplies, loaner equipment, and ongoing staff support for curriculum implementation throughout the school year.<br><br>An outreach program for charter schools was established by the Los Angeles Charter School Science Partnership. This intensive science professional-development program was funded by the California Mathematics and Science Partnership, which engages third- through eighth-grade science teachers in science content, model-based inquiry, lesson study, field investigation and research through workshops and lectures. |
| **Florida** | The University of Florida's Interdisciplinary Center for Ongoing Research/Education introduces middle- and high-school teachers to cutting-edge bioscience research methods at UF and its Emerging Pathogens Institute.<br><br>For charter school support, the state's Office of Environmental Education has partnered with the Florida Department of Education's Office of Independent Education and Parental Choice to offer free environmental, science and technology-based professional-development workshops around the state. These are specifically for charter school teachers. In addition to learning new ideas for use in science, math, social studies, language arts, physical education, music, and visual arts, teachers receive instructional manuals and qualify for in-service points.<br><br>In another program for charter school educators, experts at the Florida State University Schools (FSUS) and the university's Florida Center for Research in Science, Technology, Engineering and Mathematics (FCR-STEM) are building an online community. FSUS is a K-12 school sponsored by Florida State. This online tool is designed to support curriculum, instruction and assessment. The community will be integrated into the popular CPALMS system, the official online source for state K-12 education standards and course information built by FCR-STEM. Although charter school educators can tap into the same professional-development and technical assistance offered to all state teachers and principals, the "CPALMS Charter" community will provide additional tools and resources specific to their needs, as well as a convenient way to collaborate and communicate across district lines. The project is made possible by a $500,000, two-year grant from the Florida Department of Education to FCR-STEM and FSUS, a K-12 school sponsored by Florida State. |

| STATE | SUMMARY |
|---|---|
| **Georgia** | GaBio has received funding from the Governor's Office of Workforce Development to support teachers in 13 counties, to launch biotechnology career pathways linking high school programs to 2- and 4-year institutions. The funding, which flows to teachers, includes professional development to incorporate biotechnology tasks and career information into existing middle and high school science curricula, and training and equipment to implement high school biotechnology courses in 10 schools in four counties next year.<br><br>Georgia Intern Fellowships for Teachers (GIFT), a program of Georgia Tech's Center for Education Integrating Science, Mathematics, and Computing, offers paid four- to seven-week company internships for science, math, and technology teachers. GIFT places teachers in 70 to 100 positions annually, many of which are in biosciences.. |
| **Illinois** | In 2008 the state created the Illinois Innovation Talent Program, which connects private sector partners with 23 Illinois high schools to create problem-based curricula through which students work as teams alongside industry, government, and community experts to solve real-world problems. Professional development for teachers is provided by the Illinois Mathematics and Science Academy, a "teaching and learning laboratory" created by the state in 1985.<br><br>Sixteen Illinois institutions offer alternative teacher certification programs for individuals with a bachelor's degree and related work experience, including in biology. |
| **Indiana** | Through the I-STEM Resource Network, bioscience teachers were given tuition reimbursement for courses taken in the summer of 2010 on the use of Indiana's new inquiry-based science curriculum which was adopted in 2011. This is a part of the recent science education reform strategy led by the I-STEM Resource Network, a consortium of the Schools of Science of 15 Indiana universities and partially funded by the Governor's office. Indiana is also a pilot state for the new Project Lead the Way BioSciences curriculum. Teachers for this program receive professional development stipends for training sessions. |
| **Iowa** | The Governor's Advisory Council on STEM Education's plan recommends paid externships for in-service teachers, forgivable loans for STEM teacher candidates, and establishing partnerships for clinical placements in diverse areas. Iowa State University's (ISU's) Biotechnology Outreach Education Center educates teachers and students in a state-of-the art laboratory on ISU's campus. ISU extension specialists also conduct workshops for teachers throughout the state and provide free kits to teachers to use in their classrooms. |
| **Maryland** | The University of Maryland Biotechnology Institute (UMBI) offers professional development opportunities for middle and high school teachers. Throughout the school year, UMBI trains teachers to incorporate biotechnology activities into their classroom curricula. In partnership with the University System of Maryland and Montgomery County Public Schools, UMBI scientists work with teachers to explore the role of inquiry in science and translate their experiences into classroom activities. UMBI also offers summer professional development for teachers to explore the use of inquiry-based lab activities in teaching science. |
| **Massachusetts** | The Dept. of Higher Education administers the STEM Pipeline Fund established in Economic Stimulus Trust Fund legislation. The Fund provides grants for programs to increase the number of qualified STEM teachers.<br><br>Massachusetts Biotechnology Education Foundation (MassBioEd) is a nonprofit charitable organization committed to supporting science and biotechnology education in Massachusetts through school programs, workforce training, and lifelong learning. The MassBioEd Foundation, with funding from the Massachusetts Board of Higher Education, provides professional development training for middle and high school teachers from low income areas to enable them to integrate biotechnology content into science classes through its Improving Teacher Quality: Biotechnology Teacher Professional Development Program |

| STATE | SUMMARY |
|---|---|
| **New York** | The New York State Education Department offers grants to colleges and universities in partnership with public school districts for 50 percent of the costs of STEM teachers attending university- or college-based summer classes and institutes. The last round, in 2007, was for $2.5 million and supported 29 public and private institutions.<br><br>Through the Collaboration for Leadership in Urban Science Teaching, Evaluation, and Research (CLUSTER), the New York Hall of Science Museum offers part-time paid "explainer" work and the City University of New York offers free education courses at City College, as part of an effort to attract and develop new STEM teachers. The program also helps fellows take the New York State-certified teacher's exam and get placed with teaching jobs in New York City. |
| **Tennessee** | The Tennessee STEM Innovation Network (TSIN) is a public-private collaborative between the Tennessee Department of Education and Battelle Memorial Institute (Battelle) designed to promote and expand the teaching and learning of STEM in K-12 public schools across the state. The TSIN brings together STEM education partners and stakeholders to share best practices, enhance critical start-up efforts and boost student achievement. Through this partnership and the sharing of STEM education practices throughout the state, Tennessee hopes to create new STEM teaching and learning models that can be shared with the rest of the country.<br><br>In an effort to increase students' success in STEM education in Tennessee, the state is implementing several initiatives aimed at enhancing teachers' content knowledge and teaching practices. The Tennessee Higher Education Commission is administering a competitive grant program to provide professional development to the state's K-12 teachers in STEM academic disciplines. Professional development programs funded through this competition will be accessible statewide through the STEM Innovation Network. |
| **Texas** | Texas Regional Collaboratives for Excellence in Science and Mathematics Teaching is a network of more than 33 institutions of higher education collaborating with the Texas Education Agency, education service centers, school districts, and business partners. The network designs and implements exemplary professional development using research-based instructional models, materials, and best practices to P-12 math and science teachers.<br><br>The Texas Higher Education Coordinating Board provides funding to universities to host Mathematics, Science and Technology Teacher Prep Academies that are designed to improve the instructional skills of experienced teachers and students enrolled in teacher preparation programs in mathematics, science, and technology. |

# New Products Launched Subsequent to Center Loan Funding

| Product | Indication | Company |
|---|---|---|
| Kapvay (2010) | Attention Deficit Hyperactivity Disorder | Addrenex Pharmaceuticals |
| QuickSmear (2009) | Mastitis diagnosis (animal) | Advanced Animal Diagnostics |
| LSD-100 (2011) | Newborn screening | Advanced Liquid Logic |
| Genomics Sample preparation (2011) | Automates DNA library preparation for next generation sequencing | Advanced Liquid Logic |
| LeadCare (1997) | Portable device for lead detection in blood | Alderon Biosciences |
| DNA tracer (2013) | To track contamination for environmental monitoring | BaseTrace |
| Envisu (2007) | Ocular tissue imaging (research and clinical) | Bioptigen |
| Valkerase (2006) | Animal feed additives to improve digestion | BioResource International |
| Versazyme (2006) | | |
| Xylamax 360-P (2014) | Xylanase feed enzyme | BioResource International |
| CivaString (2013) | Brachytherapy device for treating solid tumors | Civatech Oncology |
| Coccidosis vax (2006) | Coccidosis (animal) | Embrex |
| E Matrix (2001) | Injectable biopolymer to repair tissue | Encelle |
| Petroliminator (2000) | Oily bilgewater treatment system | EnSolve Biosystems |
| Petroclean (1995) | Portable biotreatment system | EnSolve Biosystems |
| GreaseFeast, Shoreclean (2010) | Eco-friendly degreasing products | EnSolve Biosystems |
| Stasilon (2007) | Severe wound dressing | Entegrion |
| Violin strings from bioengineered spider silk (2013) | Musical instrument | EntoGenetics |
| Multiple products for cellular biomechanics | Tension, shear stress, compression to cells in 2D and 3D cell culture | FlexCell International Corp. |
| Bartonella test (2009) | Bartonellosis (human and animal) | Galaxy Diagnostics |
| AzaSite (2007) | Bacterial conjunctivitis | Inspire Pharmaceuticals |
| SERQET (2011) | Antimicrobial wipes, masks, pet products | LAAMScience |
| NMR Lipoprofile test (2000) | Lipid profile- quantifies LDL particles in body | LipoScience |
| Vantera Clinical Analyzer (2013) | Automated NMR spectrometer to identify and quantify concentrations of lipoproteins | LipoScience |
| Multiple tests and kits | Reference lab testing, clinical trial services, criminal justice, employment testing | MedTox |
| Solitude (2004) | Fly control animal feed | Piedmont Pharmaceuticals |
| Resultz (2005) | Head lice (human) | Piedmont Pharmaceuticals |
| Chewable drug delivery platform (2013) | For cats and dogs to deliver pain medication | Piedmont Pharmaceuticals |
| B-Clear Transporter Certified Products (2007) | Multipoint evaluation of transporter function in hepatocytes | Qualyst |
| Knot less self-anchoring surgical suture ( 2005) | Skin closure and tissue repair | Quill Medical |
| MDD Score test (2009) | Depression diagnosis | Ridge Diagnostics |
| Succulent Crab (2013) | Food industry | Shure Foods |
| Fuzeon (2003) | HIV/AIDS inhibitor | Trimeris |
| Multiple products and services | Human cells, media, research kits and labware | Zen-Bio |

March 25, 2008

# BYLAWS

# OF

# NORTH CAROLINA BIOTECHNOLOGY CENTER

## ARTICLE I

## Name and Seal

The name of the Corporation is the North Carolina Biotechnology Center (hereinafter known as the "Corporation").

The seal of the Corporation will be circular in form which shall bear the legend "Corporate Seal of the North Carolina Biotechnology Center" and words indicating that the corporation was incorporated in North Carolina.

## ARTICLE II

## Purposes of the Corporation

The Corporation shall provide long term economic and societal benefits to North Carolina by supporting biotechnology research, business and education statewide. It is organized and shall be operated exclusively for charitable, educational, and scientific objectives and for the public purpose of encouraging the development of the biotechnology industry in the State of North Carolina. Its objectives and purposes shall include, but are not limited to, the following:

- Strengthening North Carolina's academic and industrial biotechnology research capabilities.
- Working with business, government and academia to move biotechnology from research to commercialization in North Carolina.
- Fostering North Carolina's biotechnology industrial development.
- Informing North Carolinians about the science, applications, issues, and benefits of biotechnology.
- Enhancing the teaching and workforce-training capabilities of North Carolina's educational institutions.
- Establishing North Carolina as a preeminent international location for the biotechnology industry.

## ARTICLE III

## Members

The North Carolina Biotechnology Center shall have no members.

## ARTICLE IV

## Offices and Registered

## Agent

1. Offices. The Corporation shall continuously maintain in North Carolina a registered office at such place as may be designated by the Board of Directors. The principal office of the Corporation and such other offices as it may establish shall be located at such place(s) as may be designated by the Board of Directors.

2. Agent. The Corporation shall continuously maintain within North Carolina a registered agent, which shall be designated by the Board of Directors.

3. Changes. Any change in the registered office or registered agent of the Corporation shall be accomplished in compliance with the North Carolina Non-Profit Corporation Act.

## ARTICLE V

## Board of Directors for the Corporation

1. General Powers and Duties. The property, business and affairs of the Corporation shall be managed, controlled and directed by a Board of Directors. The Board of Directors shall have, and may exercise, any and all powers provided in the Articles of Incorporation or the North Carolina Non-Profit Corporation Act that are necessary or convenient to carry out the purposes of the Corporation and which support and foster the purposes of the Corporation as established in these Bylaws.

2. Composition.

The Board of Directors shall be comprised as follows:

1. The President of the North Carolina Biotechnology Center.

2. The President of the University of North Carolina or a person appointed by him.

3. The Chancellor of the University of North Carolina at Chapel Hill, or a person appointed by him.

4. The Chancellor of North Carolina State University or a person appointed by him.

5. The Chancellor of East Carolina University or a person appointed by him.

6. The President of Duke University or a person appointed by him.

7. The President and CEO of Wake Forest University Health Sciences or a person appointed by him.

8. The President of the North Carolina Community College System or a person appointed by him.

9. The North Carolina Secretary of Commerce or a person appointed by him.

10.-12. 3 members appointed by the Governor who shall be involved in the fields of biotechnology or life sciences or organizations supporting those endeavors.

13.-15. 3 members appointed by the Lieutenant Governor who shall be involved in the fields of biotechnology or life sciences or organizations supporting those endeavors.

16.-18. 3 members appointed by the President Pro Tem of the Senate who shall be involved in the fields of biotechnology or life sciences or organizations supporting those endeavors.

19.-21. 3 members appointed by the Speaker of the House who shall be involved in the fields of biotechnology or life sciences or organizations supporting those endeavors.

22.-40. Up to a maximum of nineteen directors to be elected by the Board of Directors for three year terms.

3. Chairman and Vice Chairman.

a. Chairman. The Chairman shall preside at all meetings of the Board and perform such other duties as may be directed by the Board. The Chairman shall be elected at each annual meeting of the Board by the Board of Directors from among its members.

b. Vice-Chairman. The Board shall elect, at the time the Chairman is elected, from among its members a Vice-Chairman who shall preside at all meetings of the Board when the Chairman is absent.

4. Term. Members elected after adoption of these revised bylaws shall serve three-year terms except that: (a) directors who serve on the board by reason of their other office as enumerated in these bylaws shall serve so long as they hold such other office; (b) directors appointed by those persons designated in Article V(2)(2)-(9) above shall serve at the pleasure of

the person who appointed them as a director, and (c) directors referred to in Article V(2)(10)-(21) above shall serve two-year terms.

5. Compensation. Members of the Board shall receive reasonable travel and subsistence expenses. No further compensation shall be allowed to members of the Board with the exception of the President of the Corporation (as defined in Article VI, Section 2 of these Bylaws) and except as provided in Article XIII, Section 1 of these Bylaws.

6. Resignation. A Director may resign at any time by giving notice thereof in writing to the Chairman or the President.

7. Vacancies. Any vacancy occurring in the board of directors, including, without limitation, a vacancy resulting from death, resignation, retirement, or removal of a director, or from an increase in the number of directors shall be filled by the appointment of a new director in the same manner in which the director who held the vacated seat was appointed. A director appointed to fill a vacancy resulting from death, resignation, retirement, or removal of a director shall serve for the unexpired term of the predecessor in office, except that those directors who serve on the board by reason of their other office as enumerated in these bylaws shall serve so long as they hold such other office.

8. Committees. The Board of Directors shall have the following standing committees having such duties as described in their committee charters or as the Board of Directors may specify.

a. Executive Committee. The Executive Committee shall consist of the Chairman, Vice-chairman, Secretary, Treasurer and the President and six (6) other members of the Board of Directors to be appointed by the Chairman and approved by the Board of Directors. The Executive Committee shall have and may exercise all the authority of the Board between meetings of the Board except as limited by N.C.G.S. §§ 55A-8-25. No two members of the Executive Committee shall be persons employed by the same institution or company.

b. Audit Committee. The Audit Committee shall consist of three board members appointed by the Chairman and approved by the Board of Directors.

c. Management Development and Compensation Committee. The Management Development and Compensation Committee shall consist of at least three board members appointed by the Chairman and approved by the Board of Directors.

d. Nominating and Governance Committee. The Nominating and Governance Committee shall consist of at least three board members appointed by the Chairman and approved by the Board of Directors.

e. Other Board Committees. The Board may establish any board committees deemed necessary to carry out the work of the Corporation. The Chairman shall appoint Board members to these committees, and the Chairman shall designate a chairman for each committee.

f. Advisory Committees. The Board or the Chairman may establish any advisory committees whose members may include board members and non-members. Members of advisory committees and their chairmen shall be appointed by the Chairman of the Board.

## ARTICLE VI

## Officers of the Corporation

1. The officers of the Corporation shall be the President, a Secretary, a Treasurer and any other officers that the Board of Directors may designate. Individuals to serve in these capacities shall be designated by the Board of Directors and given powers and duties consistent with these Bylaws. Any two or more offices may be held by the same person, except the offices of President and Secretary. However, no officer shall execute, acknowledge, or verify any instrument in more than one capacity if such instrument is required by law, by the Articles of Incorporation, or by the Bylaws to be executed, acknowledged, or verified by two or more officers.

2. Officers of the Corporation.

a. President. The President shall have and exercise general charge and supervision of the affairs of the Corporation (including authority to hire and dismiss employees and to determine the compensation of employees other than his own, except as otherwise determined by the Board of Directors or one of its duly authorized committees and shall perform such other duties and have such powers as may be assigned by the Board of Directors.

b. Secretary. The Board shall elect from among its members a Secretary who shall preside at all meetings of the Board when the Chairman and Vice-Chairman are absent and who shall, with the assistance of the Corporation staff, be responsible for keeping an accurate record of the proceedings and actions of the Board. Subject to the Control of the Board of Directors, the Secretary shall in general perform all the duties incident to the office of Secretary, and shall perform such other duties as may be assigned by the Board or the President.

c. Treasurer. The Board shall elect from among its members a Treasurer who shall have the custody of all funds, property, and securities of the Corporation, subject to such regulations as may be imposed by the Board of Directors. In general, the Treasurer shall perform all the duties incident to the office of Treasurer, subject to the control of the Board.

d. Assistant Secretary and Assistant Treasurer. The Board may elect one or more Assistant Secretaries or Assistant Treasurers not from among its members who may assist the Secretary and the Treasurer in the performance of their duties and shall have all legal authority to perform those duties.

3. Compensation. The Board of Directors shall fix the compensation of the officers of the Corporation and the President shall fix the compensation of all other employees of the

corporation, in both instances except as otherwise determined by the Board of Directors or one of its duly authorized committees.

4. Removal. Any Officer of the Corporation may be removed from office upon majority vote of the membership of the Board then in office at any regular or special meeting called for that purpose.

5. Terms of Officers and Executive Committee, Chairman and Vice-Chairman. The terms of the Executive Committee members, Officers and Chairman and Vice Chairman shall be from the time of their election to the next annual meeting or until their successors are chosen, except that the President shall serve at the pleasure of the Board of Directors.

## ARTICLE VII
## Meetings

1. Regular Meetings. The Board of Directors shall meet at least three times a year at such times and dates as designated by the Chairman of the Board, through a written call of the majority of Board members, or upon resolution of the Board. The annual meeting of the Board shall be held each year in September or at such other time as the Board may fix, for the purpose of appointing directors and officers-and for the transaction of other business.

Written notice of the time, date and place of Board meetings shall be given by the Chairman of the Board or the President of the Corporation to each member of the Board at least ten (10) days in advance of the meeting.

2. Place of Meetings. The meetings of the Board of Directors shall be held at the principal office of the Corporation, or at such other place as may be designated by the Chairman of the Board of Directors.

3. Special Meetings. The times, dates and places of special meetings of the Board may be set at the call of the Chairman, upon written call by the majority of Board members, or upon resolution of the Board.

Notice shall be given by any usual means of communication, including by telephone, telegraph, teletype, mail, private carrier, facsimile transmission, or other form of wire or wireless communication, at least ten (10) days prior to a special meeting, unless waived in writing by all members.

4. Attendance. Attendance by a member at a meeting shall constitute a waiver of notice of such meeting, except where a member attends a meeting for the express purpose of objecting to the transaction of any business because the meeting is not lawfully called.

5. Quorum. One-third of the members of the Board shall constitute a quorum for the transaction of its business and one-half of the members of the Executive Committee shall be a quorum for the transaction of its business. The quorum shall be determined at the beginning of the business meeting.

6. Parliamentary Rules. All meetings shall be conducted in an open, orderly, and fair manner and Robert's Rules of Order, as revised, shall apply to all deliberations.

7. Manner of Acting. Except as otherwise provided by law, the Articles of Incorporation, or these Bylaws, all matters before the Board of Directors shall be decided by a majority vote of the Directors present at a meeting at which a quorum exists.

Any one or more or all of the Directors or members of a committee may participate in a meeting of the Board of Directors or committee by means of a conference telephone or similar communications device that allows all persons participating in the meeting to hear each other. Participation in a meeting by means of a conference telephone or similar communications device shall be deemed presence in person at such meeting.

8. Informal Action by Directors. Any action required or permitted to be taken at any meeting of the Board of Directors or of a committee of Directors may be taken without a meeting if the text of the resolution or matter agreed upon is sent to all the Directors in office or all of the members of the committee of Directors and all of the Directors in office or all of the members of the committee of Directors consent to such action in writing, setting forth the action taken. Such consent in writing shall be filed with the minutes of the proceedings of the Board or the committee and have the same force and effect as a vote of the Board of Directors or of the committee at a meeting, whether done before or after the action so taken.

## ARTICLE VIII

## Contracts, Checks, Deposits, and Funds

1. Contracts. The Board of Directors may authorize any officer or officers, agent or agents, to enter into any contract or execute and deliver any instrument in the name of and on behalf of the corporation, and such authority may be general or confined to specific instances.

2. Loans. No loans shall be contracted on behalf of the corporation and no evidence of indebtedness shall be issued in its name unless authorized by a resolution of the Board of Directors. Such authority may be general or confined to specific instances.

3. Checks and drafts. All checks, drafts or other orders for the payment of money, issued in the name of the corporation, shall be signed by such officer of officers, agent or agents of the corporation and in such manner as shall from time to time be determined by resolution of the Board of Directors.

4. Funds. All funds of the Corporation not otherwise employed shall be deposited to the credit of the Corporation such as banks, trust companies, or other depositories as the Board may select, or as may be designated by any officer, officers, agent, or agents of the Corporation to whom such power may be delegated by the Board.

5. Acceptance of Gifts. The Board or any officer or officers or agent or agents of the Corporation to whom such authority may be delegated by the Board, may accept on behalf of the Corporation any contribution, gift, bequest, or devise for the purposes of the corporation.

6. Audits. Annually, or upon request of a majority of the Board, the accounts of the Corporation shall be audited by a reputable certified public accountant, whose report shall be submitted to each member of the Board.

7. Bond. At the direction of the Board, any officer or employee of the Corporation shall be bonded. The expense of procuring any such bond shall be paid by the Corporation.

## ARTICLE IX

## Indemnification

Each person who is or was a director or officer of the Corporation or any person who may have served at the Corporation's request as a director or officer of another corporation, partnership, joint venture, trust or other enterprise shall be indemnified to the fullest extent permitted by law against liabilities and reasonable litigation expenses, including attorney's fees incurred by him in connection with any action, suit or proceeding in which he has been made or threatened to be made a party by reason of being or having been such director or officer, except in relation to matters as to which he shall be adjudged in such action, suit or proceeding to have acted in bad faith or to have been liable or guilty by reason of willful misconduct in the performance of duty. Expenses incurred by such director or officer in defending a criminal or civil action, suit or proceeding may be paid by the corporation in advance of the final disposition of such action, suit or proceeding upon receipt of an undertaking by or on behalf of the director or officer to repay such amounts unless it shall be ultimately determined that he is entitled to be indemnified by the corporation pursuant to the foregoing provision. The right to indemnification conferred in this Article IX shall be a contract right, and each officer or director acting as such subsequent to the adoption of this Article IX shall be deemed to have acted in reliance on this right to indemnification.

The Board of Directors shall take all such action as may be necessary and appropriate to authorize the Corporation to pay the indemnification provided by this Bylaw, including without limitation, to the extent necessary, making a good faith evaluation of the manner in which the claimant for indemnity acted and of the reasonable amount of indemnity due him.

## ARTICLE X

## Relations with Public Bodies

1. Grants and Appropriations. The Corporation contemplates that in the conduct of its affairs it will from time to time receive grants or appropriations from public bodies of the State of North Carolina. The Corporation recognizes as its policy that such grants or appropriations are made subject to the control of and accounting of such public bodies of the State of North Carolina from which those grants or appropriations may be received. Expenditures by the Corporation of such grants or appropriations shall be made only for public purposes and only for the charitable, educational, and scientific purposes of the Corporation and according to law. The Corporation shall receive such grants and appropriations from the State of North Carolina or other entity making such grant or appropriation specifying particularly the services to be rendered or the expenditures to be made, the object of which shall constitute public purposes, in exchange for which such grants or appropriations shall be received.

2. Report to Public Bodies. Annually within thirty days after the annual audit required by Article VIII, Section 6, shall have been delivered to each member of the Board, the Treasurer or his designee shall transmit a copy of that annual audit to any public body of the State of North Carolina from which any grant or appropriation has been received during -- the

fiscal year to which such audit applies, together with a report briefly stating the nature of the activities carried on by the Corporation during that fiscal year and stating the Corporation's compliance, to the best of the knowledge of the Chairman, with the provisions of this Article X.

## ARTICLE XI

## Fiscal Year

The fiscal year of the Corporation shall begin on July first of each year and end June thirtieth next ensuing.

## ARTICLE XII

## Prohibited Activities

No director, officer, employee, or member of a committee of the Corporation, or any other private individual (within the meaning of Section 501 of the Internal Revenue Code or its successor provisions), shall at any time receive any of the net earnings from the activities of the Corporation, but that this shall not prevent the payment to any person of such reasonable compensation as shall be fixed by the Board of Directors for services rendered to or for the Corporation in effecting any of its purposes; and no such person shall be entitled to share in the distribution of any corporate assets upon the dissolution of the Corporation. All directors of the Corporation shall be deemed expressly to have consented and agreed that upon such dissolution or similar winding-up of the affairs of the Corporation, whether voluntary or involuntary, the assets of the Corporation then remaining in the hands of the Board, after satisfaction of the Corporation's liabilities, shall be transferred, conveyed, delivered, and paid over as provided in the Articles of Incorporation.

## ARTICLE XIII

## General Provisions

1. Limit of Use of Property and Funds to Purposes of the Corporation. No funds or property of the Corporation shall be devoted to or expended for any purpose or objective not set forth in the Corporation's Certificate of Incorporation but all the Corporation's funds and properties shall at all times be used exclusively for said corporate purposes. In no event shall any of the funds or property of the Corporation be used for personal benefit, by way of compensation, directly or indirectly, of these directors, with the exception of the President, who may be paid a salary set by the directors for services actually rendered and except that a person serving as a director may be paid compensation by the Corporation for the reasonable value of personal services rendered by him other than his services as a director.

2. Waiver of Notice. Whenever any notice is required to be given to any director or other person under the provisions of these bylaws, the Articles of Incorporation, or any applicable law, a waiver thereof and writing signed by the person or persons entitled to such notice, whether before or after the time stated therein, shall be equivalent to the giving of such notice.

3. Amendments. These Bylaws may be altered, amended or repealed, or new Bylaws may be adopted, at any meeting of the Board of Directors, by a vote of a majority of the

Directors in office, if at least ten days' written notice is given of the intention to take such action at such meeting.

I, Robert W. Spearman, Assistant Secretary of the North Carolina Biotechnology Center, hereby certify that the foregoing is a complete and accurate copy of the Bylaws duly adopted by the Board of Directors of the North Carolina Biotechnology center with all amendments thereto effective March 25, 2008 and that I am duly authorized by the corporation to so certify.

Robert W. Spearman

Subscribed and sworn to before me
this 8th day of May, 2008.

Notary Public

My Commission Expires: 6/24/10

JANATA C. SIMS
NOTARY
***
PUBLIC
WAKE COUNTY, N.C.

# North Carolina Biotechnology Center
# Board of Directors

***Peyton C. Anderson, MBA***
Chief Executive Officer
Affinergy, Inc.
P.O. Box 14650
Research Triangle Park, NC 27709
*Express Address:* 617 Davis Drive, Suite 100
Durham, NC 27713
*Phone:* 919-433-2229
*Fax:* 919-474-9407
*E-mail:* panderson@affinergy.com
*Term Expires:* 06/30/2015
*Appointed By:* Board of Directors

***John L. Atkins, III****
**Chairman, Board of Directors**
Chairman and Chief Executive Officer
O'Brien/Atkins Associates, PA
P.O. Box 12037
Research Triangle Park, NC 27709-2037
*Express Address:* 5001 South Miami Boulevard
Durham, NC 27703
*Phone:* 919-941-9000
*Fax:* 919-941-9005
*E-mail:* jatkins@obrienatkins.com
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*Appointed By:* Board of Directors

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# By Committee
# As of October 11, 2013

| Audit | Equity | Executive | MDCC | Nominating | SET |
|---|---|---|---|---|---|
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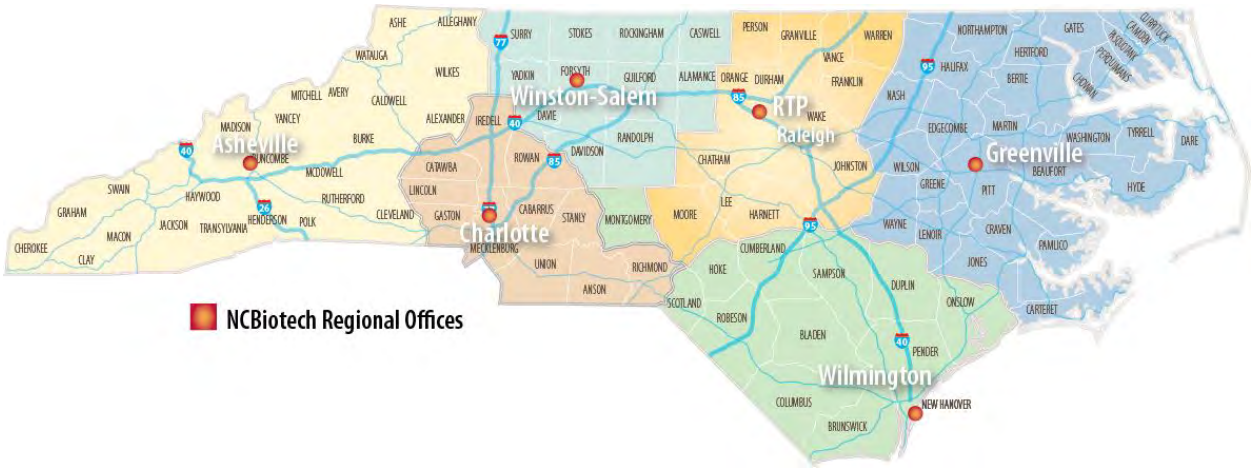
| Richard Dean | Peyton Anderson | John Cecil,Vice Chair | Sue Cole | John Atkins | Michael Batalia |
| Gerald Roach | Donald deBethizy | Sue Cole | Patricia Morton | Arthur Pappas | Goldie Byrd |
| Kay Wagoner | Eric Ward | Michael Constantino | Arthur Pappas | Gerald Roach | Richard Dean |
| | Benjamin Yerxa | Richard Dean | Norris Tolson | Lynne Scott Safrit | Barbara Entwisle |
| | | Victor Dzau | | | Terri Lomax |
| | | Roger Knight | | | Ronald Mitchelson |
| | | Patricia Morton | | | Hazell Reed |
| | | Arthur Pappas | | | Robert Wilhelm |
| | | Norris Tolson | | | |

# Regional Offices

The below map and list of counties shows the counties served by NCBiotech's regional offices.




| Piedmont Triad | Greater Charlotte | West | | East | | Southeast | Triangle |
|---|---|---|---|---|---|---|---|
| Alamance | Anson | Alexander | Jackson | Beaufort | Hyde | Bladen | Chatham |
| Caswell | Cabarrus | Alleghany | Macon | Bertie | Jones | Brunswick | Durham |
| Davidson | Catawba | Ashe | Madison | Camden | Lenoir | Cumberland | Franklin |
| Davie | Gaston | Avery | McDowell | Carteret | Martin | Columbus | Granville |
| Forsyth | Iredell | Buncombe | Mitchell | Chowan | Nash | Duplin | Harnett |
| Guilford | Lincoln | Burke | Polk | Craven | Northampton | Hoke | Johnston |
| Randolph | Mecklenburg | Caldwell | Rutherford | Currituck | Pamlico | New Hanover | Lee |
| Rockingham | Richmond | Cherokee | Swain | Dare | Pasquotank | Montgomery | Moore |
| Stokes | Rowan | Clay | Transylvania | Edgecombe | Perquimans | Onslow | Orange |
| Surry | Stanly | Cleveland | Watauga | Gates | Pitt | Pender | Person |
| Yadkin | Union | Graham | Wilkes | Greene | Tyrrell | Robeson | Vance |
| | | Haywood | Yancey | Halifax | Washington | Sampson | Wake |
| | | Henderson | | Hertford | Wayne | Scotland | Warren |
| | | | | | Wilson | | |

# NCBiotech Success Stories

*News stories from October – December 2013*

Reflector.com

# Phillips promoted to vice president of statewide operations

Monday, December 30, 2013

The **North Carolina Biotechnology Center** recently promoted **Mark Phillips** to the position of vice president of statewide operations.

With the Dec. 1 promotion, Phillips became responsible for directing and coordinating biotechnology-related growth and development activities surrounding the Biotechnology Center's five statewide regional offices.

Phillips also continues to direct such activities for the NCBiotech Eastern Office in Greenville and serves as the region's contact to the center's grant and loan funding programs. He will continue to work with companies, schools and institutions throughout the 27 counties in the region to strengthen biotechnology research, business, education and workforce training, and to identify new opportunities for commercial biotechnology.

The goal is to add to the state's 58,000-plus high-paying life science jobs at more than 500 companies, placing North Carolina in the top-three biotech states in the nation.

Phillips has more than 25 years of experience in the life sciences and telecommunications industries with knowledge in the areas of finance, customer service, human resources, governmental and external relations, as well as marketing and sales. He holds degrees in business administration and accounting from North Carolina Wesleyan College.

Phillips, a native of Roanoke Rapids, is married to the former LuAnne Robinson of Halifax. They live in Greenville with their children, Austin and Lauren.

Nextgov

# The Next Frontier for 3-D Printing: Human Organs

By Sophie Novack

December 27, 2013

Researchers at Wake Forest Baptist Medical Center are embarking on a project that is so overloaded with sci-fiesque elements that if it were a movie, you might question the screenwriter's credibility.

The "body on a chip" project will use 3-D printing—or bioprinting—technology to create mini human-organ systems about the size of a quarter to test the body's response to drugs. It's funded by a $24 million grant from the Defense Department to develop antidotes to very strong agents in the areas of chemical and biological warfare.

The ultimate goal of bioprinting is to create large, functional, implantable organs that will address the growing gap between viable organ supply and demand for transplants. Along the way, the simpler, mini-versions can be used to more effectively test drugs.

A few groups have been experimenting with bioprinting tissues and organs, but the body-on-a-chip project is unique in connecting the structures together. The chip will be able to test the impact of agents—including intense chemical weapons, more mainstream drugs, and treatments—on the human body. The project offers an alternative to animal testing—which is often inefficient and inaccurate for measuring human responses—and enables the lab to test the full system's response, rather than just one type of organ.

Scientists started making tissues by hand about 25 years ago. Using a technique known as scaffolding, cells from a patient's tissue were layered on 3-D molds and grown in an incubator outside the body. Using bioprinting technology, they are now able to feed the same information into a computer to build the tissue.

"Printing came about as a way to scale up the tissues and organs we were already creating by hand," says Anthony Atala, director of the Wake Forest Institute of Regenerative Medicine in North Carolina and the lead investigator on the project. Bioprinting enables researchers to create tissues with much greater precision and accuracy.

Atala explains the four tissues types in order of complexity: Simplest are flat structures like skin; second are tubular structures, such as blood vessels or windpipes; third are hollow non-tubular organs, such as the stomach, bladder, and uterus; and last and most complex by far are solid organs, such as the heart, kidney, and liver. These have more cells per area, more cell types, and higher nutrition requirements, and they need much more vascularity and blood supply.

To this point, scientists have only implanted the first three types from handmade tissues in patients. No bioprinted structure has been implanted.

The mini-organs are small enough that they don't require a complex vascular tree to survive. The mini-livers, hearts, lungs, and kidneys are not fully functional native organs, but they mimic the functionality for the testing

application.

The Wake Forest lab has developed one machine to bioprint different types of tissues. "It's like with an inkjet printer, where you have different colors," says Sang Jin Lee, a coinvestigator on the project. "Here we have different nozzles and different materials and cells."

The researchers are borrowing from computer microchip and biosensing technology. They will focus on one organ type at a time, beginning with the liver. As each is developed, it will be used to test drug responses individually; once they are completed, they will be connected on the chip to test the full system response.

A small handful of other groups are developing technologies to print tissues, although generally with a focus on individual organs, rather than the full system.

Organovo, a start-up in San Diego, is using bioprinting of tissues to improve research on drugs, with a recent focus on the liver.

"Reliance on animal models and cells in a petri dish [for testing] is problematic, because many diseases can't get good animal models or don't behave similarly in petri dishes," says Organovo CEO Keith Murphy. The company has succeeded in bioprinting liver tissue that lasted 40 days in a dish. Murphy says normally the tissue stops functioning in two days, which is not helpful for testing a drug that is administered for two years.

Organovo is focused on the immediate commercial impact of bioprinting, with testing done on each tissue independently. "We've contemplated putting [the parts] together over time, but you don't need 10 things to study the liver—you need the liver," explains Murphy.

"You can make living structures act like living tissues," he says. "You don't need the full organ to have an impact."

The Advanced Manufacturing Technology Group at the University of Iowa is bioprinting tissue with this idea in mind. Ibrahim Ozbolat, AMTech codirector and assistant professor of mechanical and industrial engineering, is focused on creating tissue that would accompany—not necessarily replace—the pancreas and produce insulin to help patients with diabetes.

"We're not interested in making a full natural pancreas," he says. "We're working on making something that is large enough and produces enough insulin that is transplantable."

These projects are all steps along the path toward bioprinting large organs, although that goal and its clinical application is years in the future.

"[Bioprinting organs] is still several billion dollars away," Murphy says. "If the funding is provided in five years, it could happen quickly. If it takes 20 years, it will be more over that time frame."

The hope is that as the technologies continue to develop, the manufacturing of organs could help solve the problem of rapidly growing transplant wait-lists.

Atala notes that over two sets of 10 years, the number of patients on wait-lists has doubled, while the number of organs transplanted has increased by only 1 percent—a problem the American Hospital Association has declared a public health crisis.

"This is really what drives us to do this," he says. "Everything builds on the next step."

# A-B Tech incubator lands biotech company

Dec. 18, 2013 11:06 AM | 0 Comments 

Written by
**Dale Neal**

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News

CANDLER A new biotechnology spin-off company has picked Asheville to launch its business.

F(X) Immune Co. will set up shop in January in the business incubator program at Asheville-Buncombe Technical Community College's Business Acceleration Site in Enka.

The move was announced today jointly by A-B Tech, the Economic Development Coalition for Asheville-Buncombe County and the N.C. Biotechnology Center.

Principals Michael Hickey and Joseph Martinez boast 60 years of experience in the life sciences sector. F(X) Immune Co. is a spin-off from the parent company Flow Applications Inc. headquartered in St. Louis with labs in the Atlanta area.

"This is a true biotech company. They specifically picked Asheville. They liked the wet lab space available and they want to use our trained graduates from A-B Tech," said Marilyn McDonald, who heads the college's BASE program.

The company will use lab services of the N.C. BioNetwork hosted at the Enka campus.

Over the next three years, the company plans to hire up to six lab technicians, giving priority to those those with associate degrees and those trained in the former A-B Tech Biotechnology Associate program in applied Science. Resumes and cover letters will be accepted at info@fx-immune.com

"The F(X) Immune announcement shows the community's commitment and ability to compete for the science and technology jobs of the next generation," said Paul Szurek, chair of the EDC board.

The company will develop support services for biologic research, a branch of pharmaceuticals that use living cells or DNA in vaccines, gene therapy and other medical products.



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By **Hayley Benton** on **12/18/2013 12:26 PM**
Tags:

- blogwire,
- a-b tech,
- asheville,
- ab tech,
- ,
- community college,
- economic development coalition,
- technology commercialization center,
- immune company,
- life sciences,



## Press Release

**From Economic Development Coalition for Asheville - Buncombe County:**

Asheville, N.C.–The Economic Development Coalition for Asheville-Buncombe County (EDC), Asheville-Buncombe Technical Community College and the NC Biotechnology Center jointly announced today that f(x) Immune Company will locate its new company in Asheville.

In early January 2014, f(x) Immune Co. will begin operations in the Technology Commercialization Center at the A-B Tech Community College's Business Acceleration Site in Enka (BASE) as a participant in the Business Incubator Program. f(x) Immune Co. is a spin-out from parent company Flow Applications Inc. with headquarters in the greater St. Louis area and with labs in the greater Atlanta area. f(x) Immune Co. is an immuno-diagnostic companion assay developer, offering laboratory services and biologics development support for member companies of the Pharmaceutical Research and Manufacturers of America (PhRma).

Over the next three-years, f(x) Immune Co. will hire up to six lab technicians for its new operation in Asheville. The company will give priority to associate degreed Laboratory Technicians trained in NCCLS accredited programs and graduates of the former A-B Tech Biotechnology Associate Program in Applied Science. Resumes and cover letters are invited and will be accepted atinfo@fx-immune.com. f(x) Immune Co. also plans to use lab services of the NC BioNetwork hosted at A-B Tech.

Company principals cited a number of reasons for the selection of Asheville, including the incubator and wet-labs in the tech commercialization center at A-B Tech, the robust talent pipeline for life sciences, and the EDC's strategic focus on science and technology jobs and knowledge based entrepreneurship.

"The leadership of the NC Biotech Center's Western Office traveled to our headquarters in 2011 to present these competitive advantages," recalled Michael Hickey. "The EDC, A-B Tech and the Biotech Center teamed up to do an exceptional job facilitating our visits to the community. We are confident that the Asheville operations will meet our growth objectives in 2014 and beyond."

"The f(x) announcement shows the community's commitment and ability to compete for the Science and Technology jobs of the next generation," observed EDC Board Chair Paul Szurek. "The partnership of A-B Tech and NC Biotech Center is very valuable in meeting the ambitious goals of the AVL 5x5 plan."

f(x) Immune Company is led by principals Michael H. Hickey BS, MLS (ASCP) and Joseph E. Martinez PhD. with a combined 60-years of experience in the life sciences sector. Mr. Hickey described the company's competitive advantage as the development of laboratory technologies in collaboration with its parent company Flow Applications Inc. and the US Centers for Disease Control and Prevention (CDC) that will significantly decrease the time and expense of new biologics introduction. Collectively termed Multi-plexed Opsonic Detection Technologies (MODT), these methods will satisfy the criteria set down by the Food and Drug Administration (FDA) for classes of therapeutics known as biologics inclusive of bacterial vaccines and therapeutic monoclonal antibodies.

The EDC for Asheville-Buncombe County is a public-private partnership committed to: creating and retaining high quality jobs, community leadership, and being a resource for better business decisions. The EDC accomplishes this mission through its four core services: business retention and expansion, small business and entrepreneurship, research, and marketing and recruitment. The EDC is funded by Buncombe County, the City of Asheville, the Town of Weaverville, the Asheville Area Chamber of Commerce and the AVL 5x5 Campaign.

The Asheville Area Chamber of Commerce is a member organization with over 1,800 member businesses and organizations. Chamber members collaborate with community organizations and coalitions to support the community and each other with the mission of building community through business. The Chamber is home to a 4,000 square foot Visitor Center which welcomes over 195,000 visitors per year.





Social Comments

**University News**

Appalachian State University

# A little exercise goes a long way to prevent disease in children

Posted October 8, 2013 at 6:00 pm · By ASU News
Filed under General, Health, Leisure and Exercise Science, Research, Today



NC RESEARCH CAMPUS—Studies by the Appalachian State University Human Performance Laboratory at the NC Research Campus in Kannapolis prove that when kids increase their level of physical activity, they experience positive health benefits quickly. Benefits include less body fat, increased muscular strength and reduced risk factors for major diseases like diabetes, cardiovascular disease and other metabolic and lifestyle-related disorders.

The lab is led by David Nieman, Dr.P.H., FACSM, a professor of health and exercise science in Appalachian's College of Health Sciences. He is recognized as a pioneer and expert in exercise physiology and immunology.

**Middle school youth from the greater Charlotte area receive fitness testing at Appalachian State University's Human Performance Lab at the NC Research Campus in Kannapolis through a program sponsored by the North Carolina Biotechnology Center and funded by the Golden LEAF Foundation. The program combined biotechnology and motorsports to promote an understanding of science, technology, engineering and mathematics (STEM) concepts and careers. The program also encouraged physical fitness and included fitness testing of students before and after months of fitness training.**

Although Nieman works extensively with trained athletes and adult volunteers, two recent studies gave him an opportunity to look at the effects of physical activity on the health of children. One study was conducted in China.

BeiBei Luo from the Key Laboratory of Exercise and Health Science of the Ministry of Education at Shanghai University of Sport, is a visiting doctoral student working in Appalachian's Human Performance Laboratory. She is an author of the study "A 6-week Diet and Exercise Intervention Alters Metabolic Syndrome Risk Factors in Obese Chinese Children aged 11 – 13 years" published in the Journal of Sport and Health Science.

Nieman and others from the Shanghai Municipal Center for Students Physical Fitness and Health Surveillance are co-authors of the paper.

In the study, 200 obese Chinese children were split into two groups. One group took part in a summer camp where they exercised three hours in the morning and three hours in the afternoon doing a number of activities that included swimming, running, cycling and ping pong. The second group continued with their

normal lives. Both groups maintained a caloric intake of 1,600 to 2,000 calories a day. The average child in the summer camp lost six to eight kilograms or 13 to 17 pounds.

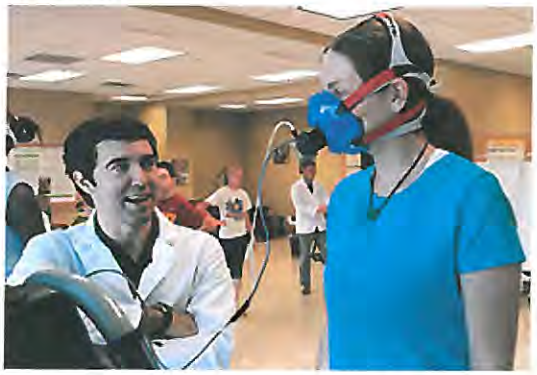
"All of that exercise and weight loss combined to bring most of their risk factors down," Nieman said. "Their blood pressure went down and insulin sensitivity improved. They were able to handle their glucose better. They had a reduction in total cholesterol. So the overall metabolic health of these children improved in just six weeks."

In another study conducted as part of the BioMoto STEM Initiative, Nieman's laboratory tested seventh and eighth graders from the greater Charlotte area using a sophisticated battery of physical fitness tests. They found a key concern for these youth is their body fat levels.

BioMoto is a program sponsored by the North Carolina Biotechnology Center and funded by the Golden LEAF Foundation and combines biotechnology and motorsports to promote an understanding of science, technology, engineering and mathematics (STEM) concepts and careers. The program also encourages physical fitness.

Students from four school systems visited the NC Research Campus for physical fitness tests at the beginning and end of the school year. Nieman's team measured body composition, muscular strength and aerobic and anaerobic fitness using systems like the BOD Pod, a Lode cycle ergometer and treadmills with metabolic equipment to measure VO2max. The fitness test battery was the same used with the pit crew of Hendrick MotorSports, one of NASCAR's most successful teams.


**A student's muscular strength is measured using a lower back and leg dynamometer during a project that combined biotechnology and motorsports to encourage physical fitness and to promote a greater awareness of science, technology, engineering and mathematics (STEM) concepts. Middle school students participated in a battery of fitness tests used in a fitness program by Hendrick MotorSports pit crew members.**



**A student participates in a treadmill $VO_{2max}$ test to determine her fitness levels. Researchers at Appalachian State University's Human Performance Lab at the NC Research Campus in Kannapolis tested middle school students' physical fitness at the beginning and end of the school year, following a program designed to improve their fitness levels and increase their interest science, technology, engineering and mathematics through activities related to biotechnology and motorsports. The researchers measured body composition, muscular strength and aerobic and anaerobic fitness. Over the course of the program, test scores showed the children in the program reduced their body fat and had improved indicators of strength and overall physical health.**

The average age of the students was 13. Their body mass index (BMI) averaged 22.4 for boys and 22.7 for girls. Nearly half of the boys and four in 10 girls were classified as overweight or obese using the Centers for Disease Control and Prevention BMI-for-age growth charts. From the results of a total of 482 students (285 boys and 197 girls) who completed both rounds of tests in the first two years of Biomoto, Nieman's team concluded that the higher the child's body fat, the less fit they were, aerobically and anaerobically. Over the course of the program, the test scores showed a reduction in body fat and improved indicators of strength and overall physical health.

"The scores on all of the tests indicated that obesity at such a young age is already impacting the health and physical well-being of these children," Nieman said. "The good news is that most children, when they get properly supervised physical activity, whether it is organized sports or an old fashioned playtime, are very happy to continue it, and they benefit from it in terms of improved health. These types of health benefits can keep them from dealing with major health issues when they are older."

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Daily Reflector

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# Another weapon to fight crime

PHOTOS BY AILEEN DEVLIN/THE DAILY REFLECTOR

Executive Director Randy Nagy shows attendees the DNA Post Amplification Lab during a tour of The Center for Advanced Forensic DNA Analysis on Wednesday.

■ Genome ID Group LLC has established a state-of-the-art laboratory facility, known as The Center for Advanced Forensic DNA Analysis, in Greenville.

BY MICHAEL ABRAMOWITZ
The Daily Reflector

Greenville took a major step toward establishing itself as an important center for biotechnology and life sciences with the introduction on Wednesday of a company known for advanced DNA analysis that is now operating in the city.

HEFFERNAN

Genome ID Group LLC has established a state-of-the-art laboratory facility, known as The Center for Advanced Forensic DNA Analysis (CAFDA) at 2305 Executive Park Circle. The center is a full-service forensic genomics laboratory, offering advanced analysis of biological evidence from crime scenes. It is one of a few private laboratories in the United States that does DNA analysis, executive director Randy Nagy said.

CAFDA has 10 employees, but plans to ramp up to 130 employees and expand within its 11,000-square-foot building as its business grows, a company official said. Michael Heffernan, chief executive of Genome ID Group, said the company is committed to raising the bar in forensic DNA science and advancing the industry through proven applications from medicine and other areas of science to serve those who fight crime and terror.

Heffernan said the biggest influence on the com-

See CAFDA, A7

## Officials already seeing dividends from lab

BY KRISTIN ZACHARY AND MICHAEL ABRAMOWITZ
The Daily Reflector

Analysis of a gun and mask at an advanced, newly opened DNA laboratory in Greenville could solve a 2001 armed robbery and an ongoing homicide investigation.

Greenville's police chief last week lauded the technological abilities of the Center for Advanced Forensic DNA Analysis (CAFDA) and the lab's quick turnaround time. Tools at the fingertips of scientists there and a partnership with Greenville Police Department will change the way detectives gather evidence at crime scenes and potentially result in needed breaks in unsolved cases, Police Chief Hassan Aden said.

Equipment from the DNA Post Amplification Lab at the Center for Advanced Forensic DNA Analysis.

Aden recently submitted a gun believed to be used in a homicide case and a mask left 12 years ago outside the scene of an armed robbery to the full-service forensics genomics laboratory. The lab, which opened earlier this year and held a tour on Wednesday, was established by the Genome ID Group, LLC to offer advanced analysis of biological evidence from crime scenes.

The gun was recovered in March and sent to the State Crime Laboratory in Raleigh for testing, Aden said.

"When you submit DNA to the state lab — and that's any state lab, not just North Carolina — they take up to a year to get that back just because of volume and resources," Aden said.

But, after meeting with Genome ID Group's chief executive officer, Michael Heffernan, and chief science officer, Dr. Kevin McElfresh, and learning more about their model for DNA lab work, Aden requested the gun back from the state facility and submitted it to CAFDA.

"I brought a team of detectives and CSI folks

See LAB, A7

# FROM PAGE ONE

the scientists perform with it. Security throughout the facility meets U.S. Defense Department and FBI standards, Nagy said.

The handling, management and processing of DNA materials are all computerized and digitized at preparatory stops along a series of screening rooms to protect the integrity of the entire chain of possession.

"During the last 20 years, there have been a lot of changes going on in the use of DNA analysis at crime scenes, leading to a new technology called SNP (pronounced "Snip")," Nagy said.

Sampling and analysis has evolved from needing a blood sample the size of a quarter, for example, to having two cells provide enough DNA for precise analysis. With the new SNP technology, scientists can take only a small portion of the DNA chain and, using digital computer technology, examine a million spots, analyze and compare the data in about two hours, rather than two years, and compare one chromosomal profile to another.

The new technology has prompted police to begin looking at the future of evidence gathering, Aden said.

"Genome has agreed to train our officers on new methods of collecting evidence at crime scenes that focus on touch DNA evidence," the chief said. "Law enforcement has no experience collecting touch DNA, so it's a whole new method for us, and I suspect that, in the future, that's going to replace collecting fingerprints."

In the past, at a burglary scene, for example, Aden said officers have been unable to lift fingerprints from wet surfaces.

"We don't even print at that point because it's impossible to get a fingerprint off of a moist surface," he said. "The best you can do at that point is try to photograph, but you will not have anything definitive."

With touch DNA technology, that will change.

Oils from the skin remain on the surface regardless of rain, Aden said. In some cases, the rain could help bring out the oils further.

"Officers and CSI forensics folks will need to put a different lens on," he said. "There's evidence there; they just need to completely retrain their mind as to what's possible. ...When you think about it a different way, and you walk into a crime scene with that knowledge, the entire process for collecting evidence changes."

Aden expects his officers will begin training at the start of the new year.

Aden said he also is intrigued by the ability of the laboratory to discern samples with multiple DNA sources and believes this technology has "lots of evidentiary value."

"You can have a piece of evidence that has two or three different samples in there, and they can actually pull those apart, which is the first I've ever heard of a lab doing that," Aden said.

Separating and identifying a mixture of several sources of DNA found in one sample, or "deconvoluting," has been the most challenging aspect of DNA analysis, Nagy said.

"With the new technology, we can take the mixed profiles from a much smaller sample, identify one million SNPs here and determine whether they are contained in the one million there, doing a straight mathematical comparison," he said.

The technology is so efficient and requires such minute amounts that even samples that degrade over time can provide adequate amounts of DNA for reliable analysis, Nagy said.

The SNP technology process has been used in medical science for about 10 years, but its use as a forensic tool is new, Nagy said — so new that its validity must still be established in a court.

The cost of the new process is double that for the current process, but its success rate for separating and identifying individual DNA from a mixed sample taken from a doorknob, for instance, also is double the old rate, Nagy said.

The Greenville Police Department will pay a "deeply discounted rate" for testing, Aden said.

"It's still cost-prohibitive at this point for every crime, but, for crimes of compelling public interest, we are willing to use this method to pursue suspects and secure prosecutions," Aden said.

"We're fortunate to have (CAFDA) in Greenville," Aden said. "This is beyond cutting edge technology that will help us create a safer community here in the city."

*Contact Kristin Zachary at kzachary@reflector.com and 252-329-9566. Follow her on Twitter @kzacharygdr.*

*Contact Michael Abramowitz at mabramowitz@reflector.com and 252-329-9571.*

AILEEN DEVLIN/THE DAILY REFLECTOR

Attendees look through the glass windows of the DNA lab on Wednesday.

## CAFDA

Continued from A1

pany's decision to make a leap of faith and come here was the seamless way that all of the agencies and officials in Greenville and Pitt County came together to convince them, including city economic development officer Carl Rees and other city staff, Wanda Yuhas and the Pitt County Development Commission, The Pitt County Committee of 100 and Mark Phillips and his colleagues at the N.C. Biotechnology Center.

"It was a bit overwhelming and hard to say no when they told us about the low cost of living and doing business here and the area's reasonable accessibility," he said. "There are some down sides; it would be nice to have more carrier options at the airport, for instance. We're a business, and have our challenges like all other businesses, but I think we have what it takes to successfully navigate those waters.

Yuhas said the project is a good example of how people from all walks of life can be directly involved in economic development.

"It started almost coincidentally with Phil Horne's conversation with Michael, and led to a group conversation with many people and offices concerned with the area's economic development and functioning as a team," Yuhas said. "There was no one source investing a ton of money, just everybody coming through with something and each agency playing the role it plays best."

The Pitt County Development Commission has been working for years to develop a life sciences cluster, and adding a company of such high caliber to the existing biotechnology base is valuable in multiple ways, Yuhas said.

Heffernan said that Greenville met some very specific logistical needs and had the kind of overall environment that is right for the company. They looked at other states, including Virginia because of its proximity to Washington, D.C., and within North Carolina. They also looked at the Triangle area because of its available talent pool.

"Phil Horne (former president and CEO of the Foundation of Renewal for Eastern N.C.) encouraged me to take a look at Greenville," Heffernan said. "My greatest question was our ability to hire the talent we needed and have them move to Greenville; it's difficult to research that ahead of time."

The life sciences company based in eastern North Carolina continues to grow, according to Phillips.

"This part of the state has a critical mass of bioscience companies," Phillips said. "The location of Genome ID Group reinforces that we have the infrastructure and the labor force to sustain continued growth in the life sciences."

Heffernan hopes that his company's decision to establish in Greenville will serve as a magnet to draw other life science technology companies to this area.

"There's something nice about being established in a small and growing community and having an influence on its (biotech industry) footprint," he said. "All boats are lifted by the rising tide."

For more information on Genome ID Group, LLC and the Center for Advanced Forensic DNA Analysis, visit http://advancedforensicdna.com.

*Serving Greenville and Pitt County for more than a century*

# OPINION



## OUR VIEWS

# DNA lab's work for police could solve more than crimes

Having a new state-of-the-art DNA analysis firm in Greenville working to help solve local crimes could offer an interesting contrast between the efficiencies of public and private lab services. If contracting with private labs can prove cost effective, scores for efficiency should not be hard to put in the private-lab win column.

Greenville Police Chief Hassan Aden told The Daily Reflector last week his department is contracting with the new Center for Advanced Forensic DNA Analysis (CAFDA) to process evidence from a homicide case. A gun from the case was recovered last March and sent to the State Crime Lab in Raleigh. The gun has now been recovered again, this time from the State Crime Lab.

"When you submit DNA to the state lab — and that's any state lab, not just North Carolina — they take up to a year to get that back just because of volume and resources," Aden said.


AILEEN DEVLIN/THE DAILY REFLECTOR

**Invited attendees were given a tour of the DNA labs at the Center for Advanced Forensic DNA Analysis on Wednesday.**

Aden submitted the gun to CAFDA for testing after a team of his detectives toured the Greenville facility and learned about its state-of-the-art DNA testing capabilities. He expects results from the testing within weeks.

That's a sharp contrast to just about any testing services conducted by the State Crime Lab. A backlog of blood tests at the state lab, for instance, is blamed in part for holding up DWI cases here. Pitt County prosecutors in October reported about 1,800 DWI cases pending, some of which were approaching three years old with no lab analyst assigned to process them due to staffing shortages at the State Crime Lab. Pitt County District Attorney Kimberly Robb is said to be looking for ways to have that type of testing done locally.

State Attorney General Roy Cooper has blamed a lack of resources for woes at the state lab. The state also has major inefficiency issues related to state pathologists overburdened with autopsy caseloads. The Charlotte Observer reported last month that crushing caseloads within the state's short-staffed medical examiner system are raising the risk of errors in criminal investigations.

With such inefficiency within the N.C. Department of Justice, companies such as CAFDA might provide a viable answer — at least for certain specialized areas of forensic science used to solve crimes. If private forensic pathology labs can perform needed services in a more timely manner, untold millions of dollars in court costs and corrections services could potentially be saved.

That makes this new relationship between CAFDA and local law enforcement worth watching.

WRAL TechWire

Posted Dec. 9, 2013 at 6:37 a.m.

# Greenville is now home to private DNA forensics lab

By JIM SHAMP, NCBiotech writer

**Tags: Biotech & Life Science, N.C. Biotech Center**

**RESEARCH TRIANGLE PARK, N.C.** — Greenville-area business boosters have been invited to an open house last Wednesday to welcome and ogle a new private specialty DNA forensics lab.

The lab will use advanced DNA analysis methods that can sift through complex samples and give forensic human identification to police, military and other clients.

The Center for Advanced Forensic DNA Analysis (CAFDA) was established by Genome ID Group, LLC, with the help of a $50,000 business development award from the North Carolina Biotechnology Center.

The funding from NCBiotech includes "clawback" contingencies requiring CAFDA to meet a series of goals and milestones, especially in the company's proposal to expand its current staff of 10 to eventually employ 130.

The lab will grow within its 11,000-square-foot building by using "the best tools available to serve those who fight crime and terror," said Michael Heffernan, Genome ID CEO.

Mark Phillips, executive director of the NCBiotech Eastern Office , worked with company officials, partner organizations and with NCBiotech colleagues to help bring CAFDA to Greenville.

"This part of the state has a critical mass of bioscience companies," said Phillips. "The location of Genome ID Group reinforces that we have the infrastructure and the labor force to sustain continued growth in the life sciences."

Other partners involved in the project include the North Carolina Department of Commerce Rural Economic Development Division, Pitt County, the Pitt County Committee of 100 and the City of Greenville.

News » Wake County December 04, 2013

# Garner tries to attract biotech to old ConAgra site

by Jane Porter

Photo by Justin Cook

*Garner is marketing the former ConAgra site to the biotech industry.*

On a June morning in 2009, an explosion tore through a Slim Jim manufacturing plant in Garner, killing four people and injuring 38 others. After the accident, ConAgra—owner of Slim Jim—packed up and shipped out of Garner for Ohio, leaving the factory abandoned and hundreds of people out of work.

Fast forward four and a half years. The 98-acre former ConAgra site is ready to go on the market early next year. The nonprofit Garner Economic Development Corp. is tasked with finding a buyer, or buyers, preferably from the biotechnology or pharmaceutical fields. The group wants to attract companies that pay higher than the Wake County average annual wage of $46,8000.

"What's good for the region," says Garner Town Manager Hardin Watkins, "what's good for Wake County, what's good for Garner, is to find something that can lift up the wages for the people that are here. If we can be a little bit patient, we're going to improve the amount of dollars coming into Wake County and put in peoples' pockets."

On Dec. 11, Garner will host an open house for developers, real estate agents and commerce officials to learn about the site. The Garner Economic Development Department will bring in biotech experts early next year to come up with a list of companies that would be a good match for the site.

The redevelopment of the former ConAgra site is about more than jobs: It's also about Garner's identity as it tries to brand itself as more than a bedroom community for Raleigh. And it's about expanding the tech and biotech culture from Research Triangle Park, Raleigh and Durham—the cities are also home to several such companies, including Citrix, Red Hat and the start-ups at American Underground—to towns outside the main metro areas.

Jim Shamp is the public relations director of the N.C. Biotechnology Center in Research Triangle Park, which works statewide to align potential life science employers with appropriate sites. Shamp says one of the center's goals is to "spread the wealth" of North Carolina's assets well beyond RTP.

ConAgra gave the town $3 million and the 98-acre site off Jones Sausage Road and pledged to help re-create the same investment on the property. The company also assumed responsibility in perpetuity for any environmental problems at the site connected to its operations.

As a result, the site—now scoured of all buildings—has "some extremely attractive features, especially for biomanufacturing," Shamp says. These include the amount of acreage, existing utilities and an on-site wastewater treatment facility that can accommodate 500,000 gallons a day. As important is its proximity to N.C. State University and Raleigh—just seven miles away—and Interstate 40.

Around 770 people worked at the Garner ConAgra plant before the explosion. The plant had operated for nearly 50 years and, at that time, was the only location where Slim Jim products were made.

Headed by Tony Beasley, the Garner Economic Development Corp. (GEDC)formed in early 2011, after ConAgra announced it would give the manufacturing site to the town. Because the soil and groundwater are contaminated with the solvent PERC, (perchloroethylene), the GEDC enrolled the site into the state's brownfields program, which indemnifies future developers from liability related to previous uses of the property. ConAgra, now in a state cleanup program, is charged with remediating the site, according to its contract with Garner. The soil can be decontaminated, but because PERC persists in groundwater, a future tenant will have to tap other water resources.

"For a developer or a new client coming in," Beasley says, "they know what the environmental concerns are, they're identified, and they're not held responsible for them. For the first five years, the developer gets a huge tax credit for redeveloping the site, so that's sort of the carrot." Local and state tax breaks total 90 percent in the first year and then are reduced for four years.

In late 2011, the group commissioned a team of consulting firms to help come up with a redevelopment strategy for the site. The goals were to bring in a company, or companies, with jobs that paid higher than county average wages; have a tax base greater than or equal to ConAgra's $55 million investment; recoup the 440 jobs that were left at the time of ConAgra's closing; and emerge as a sustainable industry cluster.

According to the RTP-based design firm O'Brien/Atkins Associates, the redevelopment could include a campus- style setting for one company's research, manufacturing and administration buildings. The site is also large enough for several companies.

Ken Atkins, executive director of the Wake County Economic Development board, says, "These are big projects, often with investments well above $100 million, with the employment of several hundred people. It could be a couple of years from beginning to final decision on projects that big. One thing we talked about with the Garner elected officials is they need to be patient. It's a big opportunity, but it's not happening quickly. It may be another three years before we can really work a deal out."

*This article appeared in print with the headline "Spread the wealth."*

Tags: **Wake County**

## latest in wake county

### Emails show Hofmann Forest nearly wasn't sold

Emails provided to the *INDY* by N.C. State University reveal some disagreement between Illinois agribusinessman Jerry Walker and former members of his company regarding plans for the 79,000-acre property.

by Jane Porter

### Dueling stories surround N.C. State's Hofmann Forest deal

Both the prospective buyer and N.C. State are claiming that a controversial prospectus showing the

genomeweb

# In Brief This Week: Becton Dickinson; Genome ID Group; ResearchDx; ACMG, 5AM Solutions

November 29, 2013

## In Brief This Week: Becton Dickinson; Genome ID Group; ResearchDx; ACMG, 5AM Solutions

By a GenomeWeb staff reporter

NEW YORK (GenomeWeb News) – Becton Dickinson this week said its board has declared a quarterly dividend of $.545 per share payable on Dec. 31 to shareholders of record on Dec. 10. At the current rate, the annual dividend for Fiscal Year 2014 would be $2.18 per share, the company said.

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The Genome ID Group has established The Center for Advanced Forensic DNA Analysis in Greenville, N.C. The center is a joint effort of Pitt County, Greenville, and the NC Biotech Center and currently has 10 employees with plans to increase that number to 130 and expand within its 11,000 square feet building "in line with business growth," it said. The new center is a full service forensic genomics lab, and offers forensic analysis of biological evidence from crime scenes.

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Contract diagnostics organization ResearchDx has expanded into India, where it will partner with Indian firms developing companion diagnostics and *in vitro* diagnostic products. It also will help companies seeking CLIA accreditation, and ISO and CAP certification.

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The American College of Medical Genetics and Genomics has extended its contract with 5AM Solutions as part of ACMG's recent five-year contract extension with the Eunice Kennedy Shriver National Institute of Child Health and Human Development for the Newborn Screening Translational Research Network Coordination Center. 5AM Solutions, an informatics and software solutions firm, will continue to "enhance the existing web-based Virtual Repository for Dried Blood Spots and the NBSTRN website," as part of the contract extension with ACMG, it said.

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# Genome ID Group Opens Advanced Forensic DNA Laboratory

Tue, 11/26/2013 - 11:35am

by The Center for Advanced Forensic DNA Analysis



Genome ID Group, LLC has established a state of the art laboratory facility, known as The Center for Advanced Forensic DNA Analysis (CAFDA), in Greenville, N.C. The company is known for developing practical applications for advanced DNA analysis methods to create unique solutions in the field of forensic human identification. The project was a joint effort of Pitt County and the City of Greenville with support from the NC Biotech Center.

CAFDA currently employs ten highly qualified professionals, but plans to ramp up to 130 and expand within its 11,000 square feet building in line with business growth.

The Center for Advanced Forensic DNA Analysis is a full service forensic genomics laboratory, offering advanced forensic analysis of biological evidence from crime scenes leading to comprehensive casework resolution. Fueled by the need for next generation technology solutions in the expeditious resolution of criminal casework, CAFDA supports law enforcement, local and federal government agencies and the intelligence community in the fight against crime and terror. The company is focused on identifying and applying proven scientific solutions to fit the challenging tasks and casework needs for DNA identification. Genome ID Group's Chief Science

Officer, Dr. Kevin McElfresh, is a recognized thought leader in forensic DNA analysis, and has played a key role in the development and evolution of technology and its application to crime scene casework analysis from the inception of DNA analysis within forensic science in the 1980s.

This past September, Genome ID Group hosted the first SNPForum conference, focusing on "New Technologies and How Best to Advance Forensic Community in the 21st Century." The conference was attended by leading scientists and thought leaders in forensic DNA science and education. The Company plans to host SNPForum 2014 in Greenville in June.

"The Pitt County Development Commission has been working for many years to develop a life sciences cluster, and adding a company of such high caliber to our existing biotechnology base is valuable in multiple ways," noted Wanda Yuhas, Executive Director of the Pitt County Development Commission. "Besides the close collaboration between the City and the County, the support provided by the NC Biotechnology Center and the Pitt County Committee of 100 enabled us to secure this project."

The life sciences company base in Eastern Region continues to grow, according to Mark Phillips, Executive Director of the NC Biotechnology Center Eastern Regional office. The Center contributed $50,000 in an economic development award to the project.

Local leaders say this company is a good example of how local citizens have an impact on economic development. Phillip Horne, former president and CEO of the Foundation of Renewal for Eastern NC, convinced the company to consider Greenville and arranged the first meeting with the County, City, and Eastern Office of the Biotech Center. Until then, the company was only considering the Triangle as a possible North Carolina location.

Source: The Center for Advanced Forensic DNA Analysis

TOPICS DNA ANALYSIS


CONTRIBUTED PHOTO

**The exterior and interior of The Center for Advanced Forensic DNA Analysis are shown in this combined shot. Genome ID Group LLC established a state-of-the-art laboratory at 2305 Executive Park Circle.**

# Joint effort helps land DNA analysis lab

**BY ABBIE BENNETT**
The Daily Reflector

Genome ID Group LLC established a state-of-the-art forensics DNA analysis laboratory called the Center for Advanced Forensics DNA Analysis (CAFDA) at 2305 Executive Park Circle in Greenville.

The company is known for developing practical applications for advanced DNA analysis methods to create solutions in the field of forensic human identification.

The lab employs 10 but plans to expand to up to 130 employees and grow within the 11,000-square-foot space.

The project was a joint effort between the city and county with support from the N.C. Biotechnology Center and other organizations.

The N.C. Biotechnology Center authorized $50,000 for the project, and the N.C. Rural Center allocated $60,000 in grant funds.

The Greenville City Council had discussed $100,000 in incentives for the lab, but the firm settled in Greenville without requiring incentives from the city or the county.

"The Pitt County Development Commission has been working for many years to develop a life sciences cluster, and adding a company of such high caliber to our existing biotechnology base is valuable in multiple ways," Wanda Yuhas, executive director of the commission, said in a news release. "Besides the close collaboration between the city and the county, the support provided by the N.C. Biotechnology Center, N.C. Commerce Rural division and the Pitt County Committee of 100 enabled us to secure this project."

The Center for Advanced Forensics DNA Analysis is expected to create 20 jobs in the first year and increase to a total employment of 126 by its fifth year. The average wage for the first year will be $98,000, and the average wage for the fifth year is expected to be about $64,000.

An open house will be held at the lab from 2-5 p.m. on Dec. 4.

Carl Rees, economic development officer for the city, said the lab fits with the city's economic development goals.

"When we launched Greenville's economic development office, we determined that our focus should be to continue to grow our city's economy on the strong university-medical base already in place," Rees said. "We are thrilled that this cutting-edge life science company has chosen Greenville as its home."

Rees said that although the firm did not require incentives from the city or county to locate in Greenville, its growth might hinge on local incentives.

The lab is a full-service forensic genomics laboratory, offering "advanced forensic analysis of biological evidence from crime scenes leading to comprehensive casework resolution," according to a release.

The lab supports law enforcement, local and federal government agencies, and the intelli-

See DNA, A5

said he acknowledged firing "more shots than I needed to." Online shopping on Cyber Monday was up at least 28 percent from the previous year according to IBM Benchmark, which tracks online sales. New Jersey Republican Gov. Chris Christie announced that he would be seeking re-election so he could continue to guide the state through a recovery from Superstorm Sandy.

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Auditors also said too many people were able to enroll students, which to high school students in 2007 and now costs the state nearly $20 million, dents and could have collec bout $18.5 million in state and local funds.

# DNA

Continued from A4

gence community in "the fight against crime and terror."

Dr. Kevin McElgresh is Genome ID Group's chief science officer and has "played a key role in the development and evolution of technology and its application in crime scene casework analysis from the inception of DNA analysis within forensic science in the 1980s."

Michael Heffernan, CEO of Genome ID Group, said the firm is "remarkably impressed" by efforts by the city, county and N.C. Biotechnology Center.

"Together they joined forces seamlessly to provide us every support and encouragement in selecting Greenville for our advanced laboratory operations," Heffernan said.

The life sciences company base in the eastern region continues to grow, according to Mark Phillips, executive director of the N.C. Biotechnology Center Eastern Regional office.

"This part of the state has a critical mass of bioscience companies," he said. "The location of Genome ID Group reinforces that we have the infrastructure and the labor force to sustain continued growth in the life sciences."

Phillip Horne, former president and CEO of the Foundation of Renewal for Eastern N.C., convinced the company to consider Greenville and arranged the first meeting with the county, city and eastern office of the Biotech Center. Until then, the company was considering the Triangle as a possible North Carolina location, according to a release.

Jimmy Garris, chairman of the Pitt County Board of Commissioners, said the commissioners are happy with the lab's location.

"We welcome any company or business to Pitt County, but are very pleased when a company with leading-edge technology like Genome ID Group decides to locate here," Garris said. "We look forward to partnering with them as they continue to grow their business in our community."

*Contact Abbie Bennett at abennett@reflector.com or 252-329-9579.*






EDENTON — Edenton police are seeking informa-

# DEALS & NEWS

## Deal Announcements

### Argos Thera Adds New Venture Capital



**Friday, November 22, 2013** 5:34:00 AM PDT | VentureDeal

Durham, North Carolina -- Biotechnology company Argos Therapeutics has secured an additional $17.5 million in its fifth round of venture capital funding.

Argos is developing what it calls "breakthrough immunotherapies that target the unique features of a patient's disease."

Specific investors in the round extension were not disclosed.

The company will use the funding to advance its ADAPT clinical trial efforts.

WRAL TechWire

Updated Nov. 21, 2013 at 2:07 p.m.

# Biotech Center CEO joins N.C. Business Hall of Fame

By WRALTechWire

**Tags: Biotech & Life Science, N.C. Biotech Center**

**RESEARCH TRIANGLE PARK, N.C.** — Norris Tolson, the leader of the North Carolina Biotechnology Center for the last six years, joined two others as North Carolina Business Hall of Fame Laureates earlier this week.

Before taking over the Biotech Center, Tolson held multiple roles in the administrations of three North Carolina governors. He also served two terms in the state House of Representatives after a 28-year business career with du Pont. Tolson, a native of Edgecome County, is a graduate of N.C. State and a U.S. Army veteran.

Also named as laureates were Alan grant Jr, CEO of Glen Raven, and Stephen Zelnak Jr., chairman of the board at Martin Marietta Materials as well as chairman and majority owner of ZP Enterprises.

The induction took place in Charlotte. The Hall of Fame is sponsored by the North Carolina Chamber and Junior Achievement of Central Carolinas.

The Hall launched in 1988 and now includes 103 members.

Honorees are selected by a panel of business and community leaders.

*WRAL Tech Wire any time:* Twitter, Facebook

# North Carolina Biotechnology Center Chief Norris Tolson Named To NC Business Hall Of Fame

*11/21/2013 10:03:14 AM*



CHARLOTTE, N.C., Nov. 21, 2013 – In his career spanning six decades, Norris Tolson has earned some distinguished titles. Executive. Representative. Secretary. President and CEO.

Tuesday night, the North Carolina Biotechnology Center president and CEO added one more: North Carolina Business Hall of Fame Laureate.

Tolson joined Alan E. Gant Jr., president and CEO of Glen Raven, Inc., and Stephen P. Zelnak Jr., chairman of the board of Martin Marietta Materials and chairman and majority owner of ZP Enterprises, in receiving the honor.

"This year's laureates are business heroes for the next generation to look up to and have made outstanding contributions in defining and reshaping the North Carolina business landscape," said North Carolina Chamber President and CEO Lew Ebert.

"On behalf of the statewide business community, I would like to thank the 2013 inductees for the example they have set for our young entrepreneurs in a time when focus, dedication and fortitude is required."

The awards are a joint presentation of the Chamber and Junior Achievement of Central Carolinas. Since the honor was established in 1988, 103 laureates have been selected by a panel of business and community leaders for their significant contributions to building and defining the North Carolina business landscape.

Tolson has led the Biotechnology Center for six years, strengthening the Center's job creation and economic development activities. The state leads top biotech clusters in employment growth over the past decade, increasing jobs by 23.5 percent.

Prior to coming to the Biotech Center, Tolson served North Carolina governors in three cabinet positions: secretary of revenue, secretary of transportation and secretary of commerce. He served two terms in the North Carolina House of Representatives after retiring from 28 years of service to E. I. du Pont de Nemours and Company. With DuPont, he held various domestic and international research, marketing and sales responsibilities.

An Edgecombe County native, Tolson graduated from North Carolina State University with a bachelor's degree in crop science and agribusiness in 1962. He also served in the U.S. Army Counter Intelligence Corps from 1963 to 1965. (Full bio)

The Hall of Fame is a roster of leaders whose contributions boosted North Carolina's growth. Past honorees include William, Thomas and John Belk, Peggy Kirk Bell, George H.V. Cecil, Boyd L. George, Governor James B. Hunt Jr., Leon Levine, Hugh McColl, J. Gregory Poole Jr., Jerry Richardson, Charlie and Ed Shelton, Temple Sloan, Bruton Smith, Allen Tate and Joan Zimmerman.

NCBiotech is a private, non-profit corporation supported by the N.C. General Assembly. Its mission is to provide long-term economic and societal benefits to North Carolina by supporting biotechnology research, business, education and strategic policy statewide.

Editor's note: A print-quality photo (http://www.ncbiotech.org/sites/default/files/pages/NCBC_0902_NorrisTolson008-4x6-266dpi.jpg ) and full biography (http://www.ncbiotech.org/author/e-norris-tolson) are available online.

Contact: Robin Deacle, vice president of corporate communications, at robin_deacle@ncbiotech.org or 919-549-8824. Visit the Biotechnology Center's website at www.ncbiotech.org.

WRAL TechWire
Posted Nov. 19, 2013 at 7:55 a.m.

# Bayer CropScience's 'Beesboro' is beehiving as planned

By JIM SHAMP, NCBiotech Writer

**Tags: Biotech & Life Science, N.C. Biotech Center, Local Firms**

*Editor's note: Jim Shamp is director of public relations for the N.C. Biotechnology Center and a regular contributor to WRALTechWire.*

**CLAYTON, N.C. -** The Clayton suburb of "Beesboro" is ready to start humming.

Actually, Beesboro is more of a research apiary than a suburb.

On Monday, global agricultural company Bayer CropScience held a ribbon-cutting ceremony to officially open the new 1,200-square-foot bee-care center on its 278-acre Clayton Training and Development Center campus.

The office, wintering cold room, extraction area, bee hive maintenance area and storage areas are part of Bayer's global push to find ways to stop honey bees from dwindling across fields and orchards.

The new Johnston County site will promote bee health throughout North America. Its previously built twin at Bayer's campus in Monheim, Germany, is targeting sustainable solutions to improve honey-bee health in Europe and elsewhere.

Bees are necessary for plant pollination. Yet many colonies are disappearing due to increasing disease and environmental threats, including a syndrome called Colony Collapse Disorder.

"Apiculture (the study of bees) is an integral part of agriculture that must continue to grow to meet the needs of an increasing global population," said Jim Blome president and CEO of Bayer CropScience LP. "Through the work of the world's brightest agricultural scientists, we can help bees continue their vital impact on crops around the world for years to come."

Bayer has also added a $20 million, 60,000-square-foot R&D greenhouse expansion at its North American headquarters nearby in Research Triangle Park for the development of new plant seeds, and recently embarked on an additional $33 million expansion there.

WRAL TechWire
Posted Nov. 18, 2013 at 7:43 a.m.

# Report shows how NC Biotech Center awards open doors to federal funding


By JIM SHAMP, NCBiotech Writer

**Tags: Opinion Analysis, Venture & Innovation, Biotech & Life Science, N.C. Biotech Center**

*Editor's note: Jim Shamp is director of public relations for the N.C. Biotechnology Center and a regular contributor to WRALTechWire.*

**RESEARCH TRIANGLE PARK, N.C. -** A recently published report by the Science Coalition (a group of research universities) lists companies around the United States that were bootstrapped by federal funding.

Significantly, all six of the North Carolina life science companies mentioned were also bootstrapped by the North Carolina Biotechnology Center. It's a clear example of the direct line between NCBiotech awards and follow-on funding from outside sources.

The report, Sparking Economic Growth 2.0, highlights 100 companies that trace their roots to federally funded university research and their role in bringing transformational innovations to market, creating new jobs and contributing to economic growth.

An accompanying online database provides free access to company profiles and allows users to sort companies by federal funding agency, university affiliation, type of innovation and other criteria.

The 10 North Carolina companies listed include the following (NCBiotech portfolio companies in boldface): Agile Sciences, BioMarck Pharmaceuticals, BioResource International, Cree, Galaxy Diagnostics, ImagineOptix, Physcient, SAS and Semprius.

A story about the report in Forbes also highlights the importance of a solid base of research universities to fuel entrepreneurship.

The report details:

- How university research and the companies born of such research are a driving force behind much of the innovation in the United States, providing essential seed corn for U.S. industry;
- The impact that research universities have on local economies, including through spin-out companies that locate close to their founding universities, contributing to the

formation of regional innovation hubs and creating jobs;

- The factors that make university research-based companies unique and contribute to their success, including the nurturing ecosystem of research universities, which provides ready access to essential tools like technology transfer offices, business incubators, business schools and workforce talent; and
- The success rate of the companies listed in a 2010 Science Coalition report, specifically those companies that were less than five years old at the time. Eighty percent of those companies remain operational today.
- The new report includes comments from Terry Lomax of North Carolina State University. The online version enables readers to click through not only the report, but also an interesting presentation database that lists some success stories from each state.

"Thanks so much for sharing this," said Eva Garland, Ph.D., when we sent the info to her at Agile Sciences. "It is very exciting to see Agile highlighted in a publication of this caliber!"

The response from Amanda Elam, Ph.D., president of Galaxy Diagnostics, went right to the core: "Awesome!"

*(C) NC Biotechnology Center*

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# Editorial: PCC's vote of confidence

Saturday, November 9, 2013
5 Comments | Leave a Comment



Tuesday's decisively favorable outcome in the Pitt Community College bond referendum illustrates how valued the college is as a vital public resource.

With a vote of 10,735 to 6,479, citizens have spoken clearly and the Pitt County Board of Commissioners should move forward with a bond resolution to fund nearly $20 million in facilities expansion projects at PCC.

The bulk of the bond, which would require a nearly 2-cent property tax increase, will fund construction of a science building to house the college's biotechnology program and other science and technology classroom space. Current biotechnology students must drive across Greenville to a county-owned facility on Greene Street.

Local industries heavily depend on Pitt Community College for workforce training. Phil Hodges, president of Metrics pharmaceutical company, publicly supported the bond referendum citing the need for more skilled workers at his company and others with openings in science fields.

North Carolina Commerce Secretary Sharon A. Decker, during a visit to Greenville in September, said the workforce has some catching up to do to take advantage of emerging opportunities in the manufacturing market. She said community colleges are critical components for closing that gap.

A portion of the bond will move the college's law enforcement training program closer to campus. The program provided Basic Law Enforcement training for more than 5,000 public safety officers last year. Area city and county law enforcement agencies, including the State Highway Patrol, depend on the program for in-service training.

Despite a 10-6 margin in favor of the bond, many citizens and some county commissioners understandably are reluctant to raise taxes in a slow and uncertain economy.

"I believe in doing what the people say do, but if you only have 10 percent of the people voting, it's not much of a mandate," Commissioner Eugene James said.

The county does have other important budgetary concerns, some of which may also require a tax increase. But 17,214 Pitt County citizens were concerned enough over the bond question to go out and vote on it. If those who stayed home don't see the outcome as a mandate, they should have voted.

PCC has the most crowded college campus in North Carolina, mostly due to the poor economy and job loss. Another record enrollment this fall includes many citizens working to reverse that trend by obtaining new job skills and better employment. Their success, and PCC's, pays off for everyone.

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## Comments

WRAL TechWire

Posted Oct. 31, 2013 at 12:34 p.m.

# Durham-based lab testing firm adding gear, people, space

BioAgilytix Labs™

By JIM SHAMP, NCBiotech Writer

**Tags: Biotech & Life Science, Quintiles, Employment, Local Firms**

**DURHAM, N.C. —** BioAgilytix Labs, a fast-growing Durham laboratory providing contract testing for pharmaceutical, biotechnology and agricultural companies, has added two new high-efficiency testing devices to its arsenal.

BioAgilytix, which specializes in tests targeting drug candidates' safety, effectiveness and mechanisms of action, has acquired two Gyrolab xP workstations.

The workstations, made by Sweden's Gyros AB, enable BioAgilytix to more quickly and accurately do more tests, using extremely small samples. Some materials, such as spinal fluid, may be available only in tiny samples. Multiple tests can require multiple samples of the precious fluid, making the Gyrolab technology especially valuable.

"As a trusted partner to six of the top 10 global pharmaceutical and biotech companies, it is vital that we broaden our technology offering and continue to deliver the highest quality bioanalysis possible," said Afshin Safavi, Ph.D., BioAgilytix founder and chief scientific officer.

"In the hands of our highly experienced scientists, the Gyros platform will allow BioAgilytix to continue to provide the quality data our customers have grown to expect, while also meeting growing capacity demands. Moreover, the nanoliter scale of the platform enables us to generate such data from small volumes of precious sample, maximizing the number of assays that can be performed."

BioAgilytix is adding personnel and space to accommodate its growing business, according to Jay Tolley, vice president of business operations. He said the company expects to end 2013 with 55 employees. Its current 30,000-square-foot facility is expected to grow by 50 percent during the next 18 months, he said.

GEN Genetic Engineering & Biotechnology News
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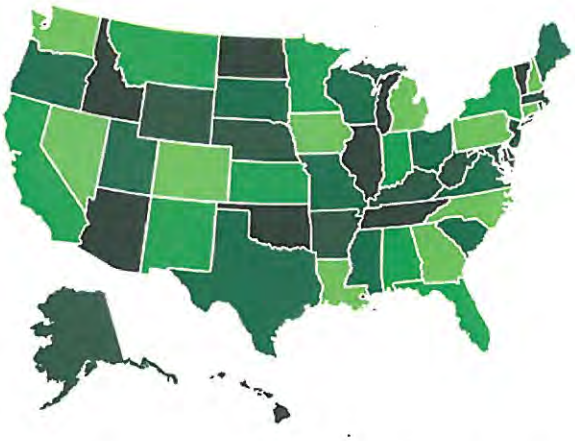
Oct 28, 2013

# Top 10 U.S. Regions for Biotech Jobs

Thinking of relocating for work? Here's where to start looking.



No longer confined to a few areas, opportunities can now be found nationwide. [© Nezezon - Fotolia.com]

To generate its list of the top 10 U.S. regions in which to secure a biotech job, GEN adopted a straightforward methodology. It identified the regions most frequently cited in biotechnology and pharmaceutical job listings. Over the past month, GEN collected data by scrutinizing five employment websites—LinkedIn, BioSpace, Medzilla, Indeed, and Monster.

The locales with the most biopharma-related jobs include the regular suspects—San Francisco and Boston—and also up and comers like the New York metropolitan area, which has grown steadily over the last few years.

## New York

While metro New York has long enjoyed access to capital and top-flight research hospitals, the Big Apple has taken a bigger bite of biopharma since the 2007–09 recession. Reasons include the long fractious community of nonprofit

teaching hospitals and research institutions finally uniting behind initiatives like the New York Genome Center; the construction of new facilities, notably the Alexandria Center™ for Life Science on Manhattan's East Side, with pharma giants such as Roche and Eli Lilly's ImClone subsidiary filling the space; and the solid support of business and political leaders led by Mayor Michael Bloomberg, who leaves office at year's end. The wide-ranging New York region includes a mix of legacy pharmas and biotechs in northern and central New Jersey, as well as mature biotechs in New York's Westchester County, led by Regeneron Pharmaceuticals, which in April said it will add 400 jobs by late 2015 through an expansion of its headquarters within The Landmark at Eastview.

## Boston/Cambridge, MA

Long the East Coast's biggest biopharma cluster, Boston/Cambridge expects several biopharma giants to complete their facility expansions over the next year, creating hundreds of new jobs—and accelerating what has been near-flat job growth since the 2007–09 recession, in part due to increased activity in neighboring New York. Vertex Pharmaceuticals will open its new headquarters at Fan Pier on the South Boston waterfront, while Biogen Idec, Novartis, and Pfizer, are building new Cambridge, MA, sites. Yet Boston/Cambridge retains numerous advantages, from its critical mass of universities, research institutions, and companies, to state support through the $1 billion Massachusetts Life Sciences Initiative, enacted in 2008 before the financial crisis and overseen by the quasi-public Massachusetts Life Sciences Center.

## San Francisco

The nation's largest biocluster began a generation ago in South San Francisco with a scrappy startup named Genentech. And while the San Francisco Bay Area has been challenged in recent years by cutbacks at its largest businesses and its high cost of doing business, as several biopharma CEOs have lamented, the region is also enjoying the IPO boom of the past year, as several homegrown biotechs have gone public including Five Prime Therapeutics and KaloBio, OncoMed Pharmaceuticals, and Portola Pharmaceuticals. As for Genentech, now a Roche subsidiary, it announced plans October 14 to spend $285 million in California but outside the Bay Area by adding 250 jobs in Oceanside (San Diego County) and Vacaville, where an existing plant will be expanded into what the company claims will be the world's biggest manufacturer of biologics. It's an outgrowth of Roche's companywide plans to spend CHF 800 million ($874.6 million) and add 500 jobs worldwide over five years to grow its production capacity for antibody-drug conjugates as well as biologics.

## Philadelphia

Greater Philadelphia enjoys proximity to the heritage pharma giants that arose in the region and Pennsylvania's neighbors to the south (Delaware) and north (New Jersey). But the region has also jumpstarted numerous biotechs over the past generation, both through the University City Science Center and, more recently, as spinouts from its universities, research institutes, and research hospitals. Among priorities for the region is attracting and retaining top talent; executive search firm Klein Hersh International held its latest Philly BioBreak invitation-only event for life sciences executives on October 15. "Our goal is to bring together the key players in the industry, many of which are locally based, and develop partnerships and strategies that will keep these great minds in the area," says Martin Lehr, co-host of Philly BioBreak, which says it has 1,300 members.

## Los Angeles

Sandwiched between California's two larger biopharma regional clusters that have grown around San Francisco and San Diego, Los Angeles had long struggled to parlay its onetime manufacturing prowess into a successful life-sci industry. But the region has enjoyed more success in recent years—part of which reflects Amgen's continued growth and acquisition of niche companies, most recently cancer drug specialist Onyx Pharmaceuticals in a $10.4 billion deal that closed October 1. Smaller biopharmas have taken root; City of Hope spinoff, Meditope, won $3.6 million in Series A funding in August to advance its monoclonal antibody (mAb) linker technology platform. Another priority for the region is training workers for biotech jobs. The Community College Consortium for Biosciences Credentials, based at Los Angeles Valley College, has been established through a three-year, $1.7 million Department of Labor grant won by the school last year.

## Chicago

The Windy City might well be called the BIO city, having hosted the Biotechnology Industry Organization's annual conventions in 2010 and this year. The April 22–25 convention gave Chicago and suburban Chicagoland a chance to trumpet several initiatives—led by a planned new downtown Bioscience & Pharmaceutical Industry Commercialization and Innovation Center. The center will be filled in part by the consortium Chicago Innovation Mentors, whose partners include Northwestern University, the University of Chicago, University of Illinois, Rehabilitation Institute of Chicago, Argonne Laboratories, and iBIO Institute's PROPEL Center, which assists life-sci startups. In January, Northwestern Medicine—a consortium of Northwestern University Feinberg School of Medicine, Northwestern Medical Faculty Foundation, and Northwestern Memorial HealthCare—announced plans for a $1 billion, 1.2 million-square-foot biomedical research facility in Chicago's Streeterville neighborhood. The University of Chicago has expanded its biotech

presence, while the University of Illinois has spent more than a decade growing the 560-acre Illinois Medical District. The region's industry anchors are established pharmas that are either based in suburbs of Chicago, such as Abbott Laboratories and its AbbVie prescription-drug spinoff, or have U.S. headquarters in the region, such as Japanese drug developers Astellas Pharma and Takeda Pharmaceutical.

## Washington, DC (includes parts of Maryland and Virginia)

The region that NIH and FDA call home has had some adjusting to do in recent years, as two if its most successful biotechs that began as homegrown startups got bought by pharma giants—MedImmune in 2007 (by AstraZeneca for $15.6 billion) and Human Genome Sciences (HGS; by GlaxoSmithKline for $3 billion). MedImmune has been transformed into AstraZeneca's biologics unit, with the company opening the Frederick (MD) Manufacturing Center in 2011. GSK is expected to keep HGS going in Maryland since the companies have partnered on drug projects stretching back two decades. The region's biocluster has won support from officials in Maryland and Virginia. In Maryland, state officials have expanded the biotechnology tax credit—to $10 million this year from $8 million—toward angel investment for spinoffs or startups, resulting in more than 150 registrations submitted by investors. In Virginia, state officials have exempted from state income tax the long-term capital gains of investors in early-stage biotechs through June 30, 2015, and increased Angel Investment Tax Credit funding in February from $4 million to $4.5 million this year and $5 million in 2014, while the Virginia Biotechnology Research Park announced plans in July for an $18 million expansion that will add up to 50,000 square feet of new office and lab space to the campus.

## Raleigh-Durham, NC (includes Research Triangle Park, NC)

A generation after Research Triangle Park succeeded by drawing the manufacturing operations of pharma giants from the costlier and colder Northeast, Raleigh-Durham is enjoying another wave of biopharma growth—not as much from drug developers as from contract research organizations. The region is home to the world's largest CRO, Quintiles, as well as numerous others including giants INC Research and PRA International, the latter acquired by Kohlberg Kravis Roberts & Co. in a deal completed September 24. The region and the rest of North Carolina have been challenged, however, by tighter state spending. In July, the North Carolina Biotechnology Center, a national model for regional bioindustry development through cross-sector partnerships, saw its budget cut by more than one-quarter or $4.6 million: It responded with a statement highlighting the industry's 23.5% job growth over the past decade, and promising to redouble its efforts to create additional biopharma jobs.

## San Diego

With apologies to Charles Dickens, 2013 has seen the best and worst of times for the San Diego region's biopharma community. The close-knit cluster was plunged into mourning when Duane J. Roth, 63, lost his life August 3, from injuries in a July 21 bicycling accident. Roth was CEO of Connect, which helped found more than 3,000 San Diego-area biopharma and other tech companies since 1985. Also on the down side, Bristol-Myers Squibb said in April it was eliminating all its roughly 400 regional jobs by the end of 2014—jobs that were created by Amylin Pharmaceuticals, which was headquartered in San Diego until the pharma giant acquired the biotech last year in a complex $7 billion, three-company deal. Three more home-grown companies found buyers in 2013: Life Technologies (acquired by Thermo Fisher Scientific for $13.6 billion plus $2.2 billion in Life Tech debt), Aragon Pharmaceuticals (Johnson & Johnson), and Trius Therapeutics (Cubist Pharmaceuticals). Regulus Therapeutics netted $51 million through a successful IPO sequencing giant Illumina dedicates its new 497,000-square-foot headquarters, whose amenities include a fitness center with coffee bar, and an outdoor amphitheater that seats 1,750.

## Seattle

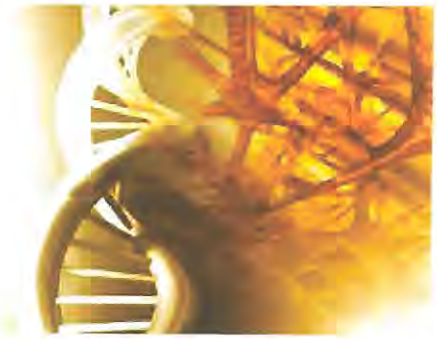
A decade ago, it looked like Seattle was taxiing on the proverbial runway for takeoff into a top-tier biopharma cluster. Since then, the region's corporate biopharma presence has struggled for reasons ranging from M&A activity (Merck snapped up the Rosetta Research Center, then shut it down) to rivals and price pressures (Dendreon has struggled with the $93,000 price of prostate cancer treatment Provenge, plus competition from prostate cancer drugs by Johnson & Johnson and Medivation). Seattle research institutes have been positioning themselves for growth: Last month the Fred Hutchinson Cancer Research Center named longtime clinical research division head Frederick R. Appelbaum, M.D., as deputy director, charged with maintaining its fiscal health. PATH drew praise from Washington state Gov. Jay Inslee for the development of its SE200 electrochlorinator with Seattle-based Cascade Designs, designed to purify drinking water in poor communities worldwide. During 2011, both Leroy (Lee) Hood's Institute for Systems Biology and the Bill & Melinda Gates Foundation moved into new headquarters sites.



**KEYWORDS:** Biotech Careers, Biotech Clusters, Regional Development

WRAL TechWire
Updated Oct. 28, 2013 at 6:12 a.m.

# Quintiles, Metabolon execs headline NC State's annual Biosciences Forum



By WRALTechWire

**Tags: Biotech & Life Science, N.C. Biotech Center, NCSU**

**RESEARCH TRIANGLE PARK, N.C. —** The North Carolina life sciences community is set to gather in Research Triangle Park on Nov. 1 for the ninth annual Biosciences Forum sponsored by N.C. State University's Poole College of Management.

Featured speakers this year include:

- John Ryals, CEO of RTP metabolomics company Metabolon
- David Lundie, vice president of technical operations at Purdue Pharmaceuticals
- Tom Pike, CEO of Durham clinical research organization Quintiles (NYSE: Q)
- Richard Kouri, professor and practice director of the Biosciences Management Initiative at NCSU.

The event will be held at the North Carolina Biotechnology Center, 15 TW Alexander Dr. 7 a.m. to noon. The event is free but registration is required. More information and registration information, is available online..

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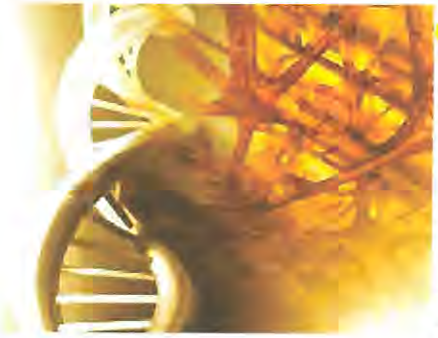
WRAL TechWire
Updated Oct. 24, 2013 at 6:29 a.m.

# Nine NC companies to present at SEBIO venture event



By JIM SHAMP, NCBiotech Writer

**Tags: Biotech & Life Science, N.C. Biotech Center, SEBIO, Venture & Innovation, Startups, Local Firms**

**RESEARCH TRIANGLE PARK, N.C. —** Nine innovative North Carolina life science companies are among the 22 chosen to pitch their technologies Nov. 6 and 7 at the 2013 Southeast BIO Investor & Partnering Forum in Richmond, Virginia.

The event, co-sponsored by the North Carolina Biotechnology Center at the iconic Jefferson Hotel, provides a showcase for some of the most promising bioscience and medical technology companies in the seven-state region, which also includes Alabama, Florida, Georgia, South Carolina, Tennessee, and Virginia.

The event gives executives of young companies picked by a selection committee of regional and national venture capitalists a chance to collect advice and investment.

One group of companies, dubbed MAIN/Stage presenting companies, have generally completed at least one round of institutional financing. They will make a 10-minute pitch to the full conference audience on Wednesday afternoon, November 6.

Companies in the EARLY/Stage event are seeking their first rounds of investment. They will participate in an individual private advisory session led by early-stage investors, entrepreneurs and experienced life science managers and service providers. Four EARLY/Stage companies will be selected to present to the full conference audience, with an overall "winner" announced at the closing lunch.

NC companies giving MAIN/Stage presentations are:

- G1 Therapeutics of Chapel Hill, developing therapeutics to protect bone marrow from damage due to chemotherapy or radiation;
- Pique Therapeutics, of Durham, developing therapeutic vaccines to treat cancer.

EARLY/Stage presenters from NC include:

- Ardeal Pharma, of Brevard, developing treatments for dermal, pharmaceutical and cosmetic markets based on Stabilized Sulforaphane;
- Camras Vision of Research Triangle Park, developing personalized care treatment for glaucoma patients to stop vision loss;
- CanDiag of Charlotte, developing cancer screening technology for early detection of breast cancer;
- Eboo Pharmaceuticals of Durham, developing pharmaceutical compounds for Parkinson's disease and other indications;
- NIRvana Sciences of RTP, developing novel dyes with ultra-narrow spectral properties;
- Novocor Medical Systems of Raleigh, developing a rapid-chilling device to induce therapeutic hypothermia;
- T3D Therapeutics of RTP, developing therapeutic to treat Alzheimer's disease.

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## Editor's Blog

The latest blog posts from our WRAL Tech Wire and WRAL editors.

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WRAL TechWire
Posted Oct. 15, 2013 at 3:03 p.m.

# NC Biotechnology Center awards $550,000 in loans, grant

By JIM SHAMP, NCBiotech Writer

**Tags: Biotech & Life Science, N.C. Biotech Center, Local Firms, Startups**

**RESEARCH TRIANGLE PARK, N.C. —** The North Carolina Biotechnology Center issued $550,660 in loan and grant funding to support life science business and commercialization during its first fiscal quarter ended September 30, 2013.

NCBiotech has been awarding this type of funding since the Center was established in 1984. The awards have helped the state become one of the nation's top three in biotech, with more than 500 life science companies employing more than 58,000 people at an average salary exceeding $75,000.

All three loans went to Chapel Hill companies this time. The grant funding helped support a scientific meeting at Wake Forest University.

- Achelios Therapeutics received a $250,000 Small Business Research Loan (SRL) to help fund a Phase IIa clinical study in humans to determine the most effective dosing of its topical cream, ELS-M11, to treat acute migraine.
- KindHeart was awarded a $249,060 SRL to help fund development of its Cardiac Surgery Simulator. KindHeart specializes in lifelike simulation devices for educating and training surgeons and residents, and assisting medical device companies in selling their products. Its surgery simulation systems use animated animal organs to create what appear to be living human patients upon which real surgical procedures can be practiced. Its proprietary Staged Reality uses computerized pumps and fluids in these organ systems to teach curriculum-driven, real-world surgical procedures and test new medical products in ways that were not previously possible.
- LotusBioEFx received a $50,000 Company Inception Loan to help position the company for seed funding. LotusBioEFx is developing metal alloy microparticles to be used in antimicrobial coatings on medical devices and other products to prevent the spread of infection in hospitals and other healthcare facilities.
- A $1,600 Biotechnology Event Sponsorship grant helped support a Sept. 11 and 12 stem cell workshop at WFU. The event focused on the rapidly emerging field of genetic

reprogramming using a process called induced pluripotent stem cell technology. It's opening new opportunities in biomedical research and commercial development.

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## Invitation to attend an ASTA FuSE Initiative southern agriculture forum

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Alexandria, Virginia, USA
October 15, 2013

As a seed industry professional, you are an important part of the intended audience for the ASTA FuSE Initiative's upcoming "Educational Unit" forum!

The Future Seed Executives (FuSE) Initiative is an official sub-committee of the American Seed Trade Association's (ASTA) Management Skills Committee. FuSE Educational Unit forums are designed as regional opportunities to expand learning, cultivate management skills, promote networking, and improve general understanding of the seed industry.

The upcoming Educational Unit will not only provide an excellent learning opportunity, but also a venue for leaders like you to exchange ideas with a highly interdisciplinary group of scientists, seed industry executives and future executives, and experts in the challenges and opportunities of southern agriculture.
We would like to personally invite you to attend our upcoming Southern Agriculture Educational Unit, hosted by Cotton Incorporated and Syngenta:

***FuSE Educational Unit in Raleigh, North Carolina October 22-24, 2013***

**Tuesday, October 22nd** - The event will kick-off with an evening reception sponsored by Syngenta at the Baby Moon Cafe in Morrisville, followed by two days of programming that includes presentations from industry leaders and tours of world-class research facilities.

**Wednesday, October 23rd** - The program will include a tour of Cotton Inc.'s Textile Research facilities, demonstrating stops along the cotton value chain, as well as a visit to the North Carolina Biotech Center (NCBC). Speakers will include Kater Hake, Vice President of Agricultural and Environmental Research for Cotton Inc., Dr. Alan Franzluebbers, USDA Professor of Soil Science at North Carolina State University, and Paul Ulanch, Executive Director of NCBC. Discussions topics will include NCBC's role in promoting biotechnology in North Carolina; crop-cover research; the emerging issues in southern agricultural production; and efforts to overcome regional challenges with soil health.

**Thursday, October 24th** - Participants will tour Syngenta's Research Triangle Park research labs, where subject matter experts will present an overview of current regional and national challenges to agricultural production and Syngenta's pipeline of seed solutions, including water optimization and insect/weed resistance. Attendees will also tour Syngenta's new crop lab, a state of the art facility housing research projects on crops such as corn, soybeans, sugar cane, rice, cereals, vegetables, and sunflowers.

**Please register today!**
Space for the event is limited, so please register today at www.amseed.org/education/fuse/upcoming-events. Students and ASTA members are offered a registration discount. The registration fee includes the Syngenta evening reception, the morning refreshments and luncheon on Wednesday, October 24, and all Educational Unit programming.

For more information about FuSE, please visit the website, www.amseed.org/education/fuse/

**More news from:** ASTA - American Seed Trade Association*

**Website:** http://www.amseed.org

**Published:** October 15, 2013





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# Event is Latest in String of Life Sciences, Technology Industry Participatory Efforts

*10/15/2013 2:44:25 PM*

RESEARCH TRIANGLE PARK, N.C. -- Innovative PR, media relations, and online publishing consultancy Global Media Strategies (www.gmsinnovate.com) is pleased to announce its participation in the upcoming NU Tech Crop Science & Biotechnology Roundtable at the North Carolina Biotechnology Center on October 25, 2013.

Company President David Menzies will be present to discuss best practices in biotechnology public relations and branding, reflecting on past and present work for the consultancy's client portfolio.

This is the latest in a string of 2013 life sciences and technology industry-oriented events in which Global Media Strategies has participated. In August, the consultancy exhibited at the 2nd Annual Triangle Biotech Research Symposium, while in May it supported the world's largest multi-disciplinary multi-sector conference and marketplace of vetted innovations, innovators and technology business developers and funders, TechConnect World, in Washington, D.C.

The NU Tech Roundtable features presentations by Monsanto Company, Syngenta Biotechnology, Inc., and Bayer CropScience in addition to "Manipulation of stomatal opening increases photosynthesis and plant growth" by Dr. Toshihiro Kinoshita, professor of Nagoya University, and "Two B3 domain-EAR motif transcriptional repressors are essential to repress embryonic program after seed germination in Arabidopsis thaliana" by Dr. Hironaka Tsukagoshi, designated lecturer of Nagoya University.

NU Tech promotes tech transfer and research collaboration between U.S. partners and Nagoya University, mainly focusing on the life sciences and biotechnology in Research Triangle Park. Nagoya University is one of seven prestigious "Imperial" universities in Japan with 13 Graduate Schools, three Research Institutions and 18 Research Centers. 16,000 full time students study and work with 2,000 full time faculty members and 2,000 support staff.

Since launching in 2007, Global Media Strategies has successfully generated positive publicity for clients in major print, electronic, television and radio media outlets in a wide variety of industries including technology, life sciences and manufacturing. The consultancy's signature Proposal => Engagement => Success model is proven effective at achieving results with a scalable package of services that can be tailored to each client's specific needs as they relate to differentiating themselves from competitors; communicating value propositions; and providing easy access to products and services through customized, cost-effective public relations solutions.

Global Media Strategies provides each client with premier service and individualized attention, regardless of size, industry, or type of services required. The types of clients served include Clinical Pharmacology; Healthcare Technology; Pharmaceutical Manufacturing; Analytical Instrumentation; Biomedical Product Manufacturing; Pharmacovigilance; Intellectual Property Law; Information Technology; Product Design and Engineering; Software; Retail; and Nonprofit.

For more information about Global Media Strategies, visit www.gmsinnovate.com.

About Global Media Strategies

Global Media Strategies is an innovative PR, media relations, and online publishing consultancy specializing in getting businesses and organizations in front of target audiences. We use proven effective communication tools and methodologies to increase brand awareness and drive sales for clients in new and emerging markets. Global Media Strategies operates out of the technology-rich Research Triangle Park region of North Carolina, USA, a hotbed of innovation and economic growth, and home to some of the leading life sciences and technology firms in the world. For more information, visit www.gmsinnovate.com.

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# NCBiotech Loans $550,000 to Boost Young Companies

*10/15/2013 10:02:22 AM*

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RESEARCH TRIANGLE PARK, N.C. Oct. 15, 2013 -- The North Carolina Biotechnology Center issued $550,660 in loan and grant funding to support life science business and commercialization during its first fiscal quarter ended September 30, 2013.

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NCBiotech is a private, non-profit corporation supported by the N.C. General Assembly. Its mission is to provide long-term economic and societal benefits to North Carolina by supporting biotechnology research, business, education and strategic policy statewide.

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# Linde to Discuss Capabilities to Improve Quality and Safety of Biotech and Pharma Operations at NC Bioscience Conference



**Linde LLC**
575 Mountain Ave.
Murray Hill, NJ, 07974
USA
Contact Information

Press release date: October 14, 2013



Murray Hill and New Providence, New Jersey, U.S. – Biotech and pharmaceutical firms looking for ways to improve the quality and safety of their operations are invited to meet with cryogenic gases experts from Linde Gas North America LLC., at the North Carolina Bioscience conference to be held at the North Carolina Biotechnology Center in Research Triangle Park. Linde representatives will be available during the networking dinner on October 17, as well at the annual conference on October 18.

Peter Stuber, program manager-Chemistry for Linde Gas North America LLC, said, "The Bioscience conference gives Linde an opportunity to outline its capabilities for biotechnology and pharmaceutical industry processes. As a preferred BIO Business Solutions Partner with the Biotechnology Industry Organization (BIO), Linde offers member companies technical know-how, special pricing and rebates on gases such as oxygen, nitrogen, carbon dioxide, and specialty gas mixtures. With more than 50 production facilities and 220 active distributor locations throughout the U.S., Linde offers exceptional service and cost-saving benefits to members companies."

Linde will also highlight the advantages of two of its cryogenic systems:

- Linde Cryoservices™ which is specially designed to serve all the requirements of biotech organizations that need to cryogenically store irreplaceable specimens, such as cord blood, bone marrow, cell lines, blood and organs for transfusion and transplantation.
- VERISEQ® Nucleation, a proprietary technology for nucleation control during lyophilization (freeze drying) of pharmaceuticals and biologics.

Linde Gas North America LLC. is a member of the Linde Group, a world-leading gases and engineering company with around 62,000 employees in more than 100 countries worldwide. In the 2012 financial year, Linde generated revenue of EUR 15.280 bn (USD 19.9 bn). The strategy of the Group is geared towards long-term profitable growth and focuses on the expansion of its international business with forward-looking products and services. Linde acts responsibly towards its shareholders, business partners, employees, society and the environment – in every one of its business areas, regions and locations across the globe. The company is committed to technologies and products that unite the goals of customer value and sustainable development.

For more information, see The Linde Group online at www.linde.com
Contact:
Amy Ficon
Linde corporate communications
908-771-1491

**More New Product News from this company:**

Portable Nitrogen Vessels enable storage on location.

Spiral and Tunnel Freezers meet poultry industry needs.

Calibration Gas Mixture features 110 components.

Specialty Gas Cylinder extends sensitive instrument life.

Hygienic Cryogenic Tunnel Freezer accelerates IQF process.

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**Other News from this company:**

Linde to Display Innovative Nitrous Oxide Delivery System for Emergency Department Use at ACEP Conference in Seattle

Linde Praises President Obama and Congress for Passage of Helium Legislation Critical to a Variety of Manufacturing Operations

Linde White Paper Shows How Dry Ingredient Chilling Helps Bakery Manufacturers Save Time and Reduce Waste

Linde Hydrogen Fueling Stations Reach Over Half Million Fills

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WRAL TechWire
Posted Oct. 4, 2013 at 11:00 a.m.

# Greenvile firm lands share of $40M federal vaccine contract


By JIM SHAMP, NCBiotech Writer

**Tags: Biotech & Life Science, N.C. Biotech Center, Local Firms**

**RESEARCH TRIANGLE PARK, N.C.** — Greenville's DSM Pharmaceuticals, the largest contract manufacturing facility in North America, is sharing in a $40 million federal contract while adding to North Carolina's renown as "Vaccine Central."

DSM's 1.5 million-square-foot pharmaceutical manufacturing site on its 640-acre, 29-building campus is one of four sharing a $39.8 million contract to boost the nation's ability to manufacture influenza vaccine quickly in a pandemic.

DSM, part of a multi-billion-dollar Dutch conglomerate, was named by the U.S. Department of Health and Human Services to be part of a "fill and finish" manufacturing network, which will cover the final steps in the vaccine manufacturing process.

In announcing the selection earlier this week, HHS officials said the network will potentially increase the national flu vaccine production capacity by 20 percent.

The Biomedical Advanced Research and Development Authority (BARDA), in HHS' Office of the Assistant Secretary for Preparedness and Response, awarded the new contracts to DSM plus Cook Pharmica of Bloomington, Ind.; JHP Pharmaceuticals of Parsippany, N.J.; and Nanotherapeutics of Alachua, Fla.

### Responding to Man-Made, Natural Threats

"No longer will fill and finish manufacturing be the limiting factor in making pandemic influenza vaccines or other products available in a public health emergency," said BARDA Director Robin Robinson, Ph.D. "The fill and finish manufacturing network will be an integral part of other national assets that address the need for timely manufacturing of medical countermeasures to respond to man-made and natural threats."

DSM, which has invested more than $160 million since 2001 to expand and modernize, has twice been named Pitt County Industry of the Year – first in 2007, and again in February 2013. In 2012 alone, DSM added 139 jobs at its Greenville site.

### NC Leads in Vaccine Discovery, Manufacturing

North Carolina's leadership in vaccine development and production is based on facilities such as Novartis' $1 billion cell-culture facility in Holly Springs and the $42 million Medicago factory in Research Triangle Park that grows viral-like particles in tobacco leaves, recently acquired by Mitsubishi.

Nearby, in Durham, is Merck's 650,000-square-foot egg-based multi-vaccine facility, also now approaching the $1 billion investment mark..North Carolina is also home to the North American headquarters for GlaxoSmithKline, and has major vaccine manufacturing facilities owned by Pfizer, Greer Laboratories and Grifols.

There are also numerous development-stage vaccine companies such as Arbovax in Raleigh, initially targeting dengue but with a platform technology that's also believed capable of combating West Nile and other mosquito-borne diseases.

*(C) NC Biotech Center*

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## Editor's Blog

The latest blog posts from our WRAL Tech Wire and WRAL editors.

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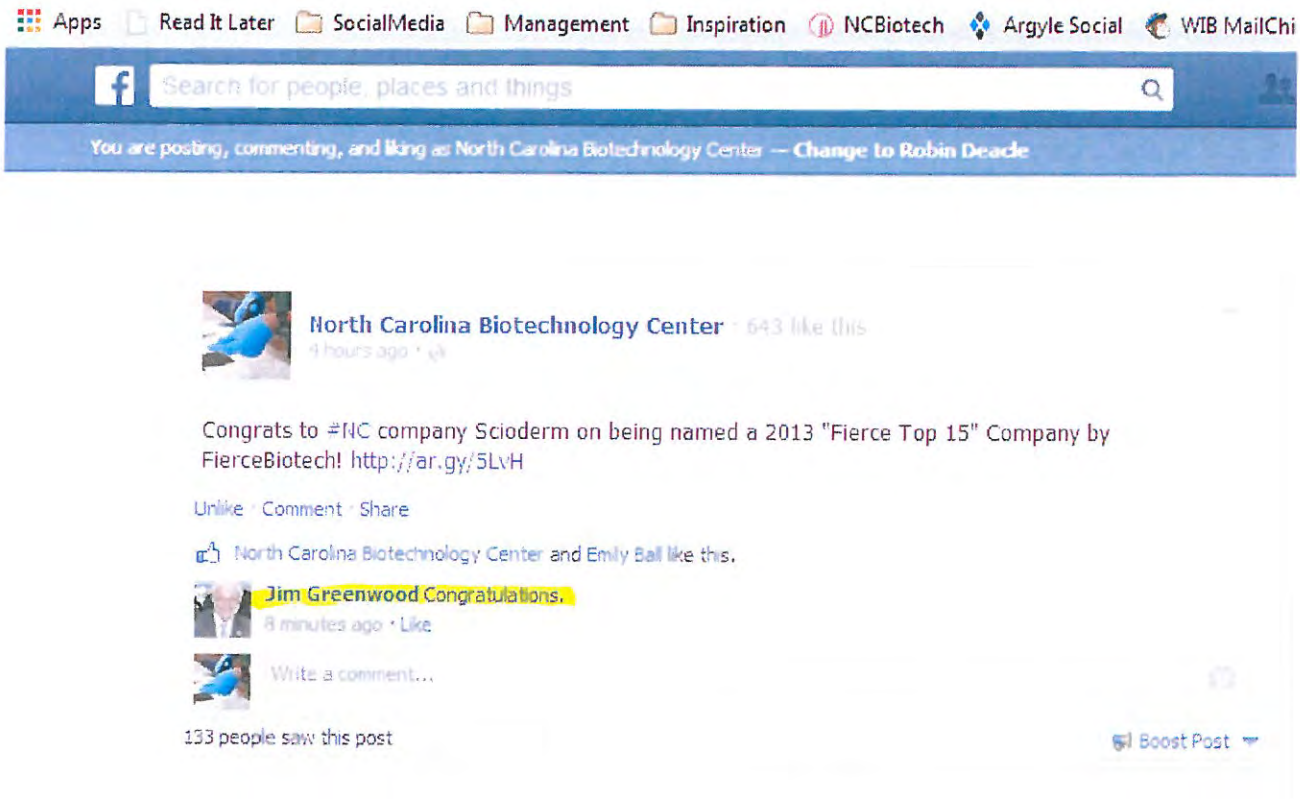
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## Eastern Region

**Chair: H. L. (Steve) Stephenson**, III, Attorney, Ward & Smith, P. A.

**Vice-Chair:** Vacant

**Immediate Past Chair: David Peele**, Ph.D. , President, AVOCA, Inc.

- **Clyde L. Brooks Jr.**, MD, Vice President, Medical Affairs, Vidant Medical Group
- **John D. Chaffee**, President and CEO, North Carolina's Eastern Region
- **Bill Cooper**, Manager, BioNetwork - Bioprocessing Center, Technology Enterprise Center
- **John Gessaman**, President & CEO, Carolinas Gateway Partnership
- **Marty Hackney**, Director, Entrepreneurial Initiative, East Carolina University
- **Ron Heiniger**, Ph.D., Associate Professor - Extension Corn Specialist, North Carolina State University
- **Joanna Helms**, President and COO, Wayne County Development Alliance, Inc.
- **Phillip Hodges** (Phil), President, Metrics Inc.
- **Joe Landino**, Joe Landino Farms
- **Robert M. Lust** Ph.D., Professor and Chairman of Physiology, East Carolina University
- **Mark Phillips**, Executive Director, Eastern Office, North Carolina Biotechnology Center
- **Vann Rogerson**, President & CEO, North Carolina's Northeast Commission
- **Thomas Schultz**, Duke University – Marine Laboratory, Director, Marine Conservation Molecular Facility
- **Edmund (Ed) Stellwag**, Ph.D., Director, Genomics Core Facility & Associate Professor, Department of Biology, East Carolina University
- **Mike Wilkins**, Sr. VP, Statewide Operations & Economic Development, North Carolina Biotechnology Center

## Charlotte Region

**Chair:** Vacant

- **Mark Arizmendi**, Founder, President, and CEO, Northwestern Capital Partners, Charlotte
- **Magdy Attia**, Ph.D., Chair of the Council of Deans, Dean of Science, Technology, Engineering and Mathematics (STEM) College, James B. Duke Distinguished Professor, Johnson C. Smith University, Charlotte
- **Bill Burton**, MBA, Senior Vice President & Senior Client Manager, Commercial Banking Healthcare and Institutions, Bank of America Merrill Lynch, Charlotte
- **Corie Curtis**, Executive Director, Greater Charlotte Regional Office, North Carolina Biotechnology Center, Charlotte
- **Dane Fisher**, Ph.D., Associate Professor of Biology, Pfeiffer University, Misenheimer
- **Linda Greer**, EdD, Vice President for Economic & Workforce Development, Gaston College, Dallas
- **John K. Hudson**, Managing Director & Group Head of Consumer, Healthcare & Gaming Investment Banking, Wells Fargo Securities, Charlotte
- **Susan MacIsaac**, Ph.D., Analytical Innovations Team Lead, Monsanto Company, Kannapolis
- Former Gov. **Jim Martin**, Ph.D., Senior Advisor, McGuireWoods Consulting, Charlotte
- **Scott Millar**, President, Catawba County Economic Development Corporation, Hickory
- **Bruce Parker**, President, Parker Medical Associates, Charlotte
- **Ken Russell**, Ph.D., Director, Enterprise Strategy, Cisco, Charlotte
- **Katherine Taber**, Ph.D., FANPA, Assistant Director-Education, VISN 6 MIRECC, Research Professor, VA College of Osteopathic Medicine, Research Health Scientist, W.G. "Bill" Hefner VAMC, Salisbury
- **Rosie Tong**, Ph.D., Director, Center for Professional and Applied Ethics, Distinguished Prof. of Healthcare Ethics in Philosophy, University of North Carolina at Charlotte, Charlotte
- **Steve Wallenhaupt**, MD, Executive Vice President and Chief Medical Officer, Presbyterian Healthcare/Novant Health, Charlotte
- **Bob Wilhelm**, Ph.D., Vice Chancellor for Research and Economic Development, Executive Director of the Charlotte Research Institute, University of North Carolina at Charlotte, Charlotte
- **Mike Wilkins**, Sr. VP, Statewide Operations & Economic Development, North Carolina Biotechnology Center
- **Mark Phillips**, VP, Statewide Operations, North Carolina Biotechnology Center

**Emeritus Member: Chris Murphy**, MBA, MS Ed., President, Business Development Testing, Charlotte

## Piedmont Triad Region

**Chair: Karen Hicks**, Vice President, Human Resources, Targacept, Inc.

**Vice Chair: Michael F. Kelly,** Chief Operating Officer/Chief Financial Officer, Piedmont Pharmaceuticals

- **Jerry Barker**, President, Ocular Systems
- **Michael Batalia**, Ph.D., Executive Director, Commercialization, Product Innovation and Commercialization Services, Wake Forest University Health Sciences
- **Tim Bertram**, D.V.M., Ph.D., President, Research and Development and Chief Science Officer, Tengion, Inc.
- **Morris J. Clarke**, Ph.D., Associate Professor, Winston-Salem State University
- **Bill Dean**, Pathologists Diagnostic Laboratory, P.A.
- **Robert Egleston**, President and CEO, DataMax Corporation and DataMax Foundtion
- **Daniel (Dan) E. Erb**, PT, Ph.D., Dean, School of Health Sciences, High Point University
- **Roger E. Gordon**, Ph.D., Board Advisor to Certi-Rx
- **Andrew Hebard**, President and CEO, Technology Crops International
- **Nancy Johnston**, Executive Director, Piedmont Triad Office, North Carolina Biotechnology Center
- **Alan F. Jones**, Director Business Development, Duke Energy Corp.
- **John R. Merrill**, Executive Director, Gateway University Research Park
- **George R. "Randy" Parker**, Ed.D, PE, President, Guilford Technical Community College
- **Randy L. Pool**, PE, Managing Principal, Stantec Inc.
- **Russ Read**, Executive Director, National Center for the Biotechnology Workforce, Forsyth Technical Community College
- **Cynthia (Cindy) B. Rothschild**, Ph.D., Partner, Kilpatrick Townsend & Stockton LLP
- **James (Jim) G. Ryan**, Ph.D., Founding Dean, Joint School of Nanoscience and Nanoengineering, NC A&T and UNC-G
- **Scott J. Sewell**, Vice President, Technology Acquisition & Development, Cook Medical
- **Terri Shelton**, Ph.D., Vice Chancellor for Research and Economic Development, University of North Carolina at Greensboro
- **Penny Whiteheart**, Executive Vice President, Piedmont Triad Partnership
- **Michael Wilkins**, Sr VP, Statewide Operations & Economic Development, North Carolina Biotechnology Center
- **Mark Phillips**, VP, Statewide Operations, North Carolina Biotechnology Center

## Southeastern Region

**Chair: Steve Yost**, Director, NC Southeast, Elizabethtown

- **Daniel G. Baden**, Ph.D. (Dan), Director, UNCW Center for Marine Science, Wilmington
- **Jim Bradshaw**, Executive Director, Brunswick County Economic Development Commission, Bolivia
- **Michael G. Cain**, President, Wilmington Investor Network, Wilmington
- **Terry M. Coffey**, Ph.D., President, Murphy-Brown East, Warsaw
- **Lisa Ferrara**, CEO, Orthokinetic Technologies, Shallotte
- **Eugene T. Haley (Gene)**, CEO, Wilmington Pharmaceuticals, Wilmington
- **Leonard D. Holmes**, Ph.D. (Len), Director, Biotechnology Business & Training Center, University of North Carolina Pembroke, Pembroke
- **Steve Janz**, Vice President, Marketing and Business Development, Flow Sciences, Leland
- **Randall Johnson**, Director, Southeastern Office, North Carolina Biotechnology Center, Wilmington
- **Kimberly Jones**, Founder and Chief Scientist, Alganomics, Southport
- **Leslie Lowry**, Manager, NCCCS BioNetwork BioAg Center, Lumberton
- **Eric B. McKeithan**, Ed.D., President, Cape Fear Community College, Wilmington
- **Michael McKenna,** Principal, Navigator Life Science Advisory, Wilmington
- **Gary Miller**, Chancellor, University of North Carolina Wilmington, Wilmington
- **Deb Mosca,** Chief Executive, Marine Bio-Technologies Center of Innovation, Wilmington
- **Julie Orr,** Founder, President and CEO, Modoc Research Services, Wilmington
- **Carlos Parajon**, Managing Partner, Harbor Island Equity Partners, Wilmington
- **Jane Smith**, Chair, North Carolina Southeast Regional Partnership, Lumberton
- **Alan Stout**, Vice President, Glycotech; and Lead Entrepreneur, Carolina Algae, Leland
- **John Swope**, Executive Director, Sampson County Economic Development Commission, Clinton
- **Patrick Walsh,** CEO, AAIPharma, Wilmington
- **Rebecca Westbrooks**, Instructor, Southeastern Community College, Whiteville
- **Mike Wilkins**, Sr. VP, Statewide Operations & Economic Development, North Carolina Biotechnology Center
- **Mark Phillips**, VP, Statewide Operations, North Carolina Biotechnology Center

**Ex-Officio Member: Mark W. Lanier**, Assistant to the Chancellor and Assistant Secretary to the UNCW Board of Trustees, University of North Carolina Wilmington, Wilmington

## Western Region

**Chair**: **Anthony G. Calamai**, Ph.D., Dean of College of Arts and Sciences; Professor of Physics and Astronomy, Appalachian State University, Boone

**Vice Chair**: **Scott T. Hamilton**, President and CEO, AdvantageWest North Carolina, Fletcher

- **George B. Briggs**, FASLA, Executive Director, The North Carolina Arboretum, Asheville
- **Louis E. Buck,** Ph.D., Dean, College of Business, Western Carolina University, Cullowhee
- **Mark R. Burrows**, Economic Development Director, Transylvania County, Brevard
- **Dale Carroll**, Executive Director, Western Office, North Carolina Biotechnology Center
- **John F.A.V. Cecil**, President, Biltmore Farms, Asheville
- **John Allen Locke**, Director of Philanthropic Initiatives, Mission Healthcare Foundation, Asheville
- **Mike Wilkins**, Sr. VP, Statewide Operations & Economic Development, North Carolina Biotechnology Center
- **Mark Phillips**, VP, Statewide Operations, North Carolina Biotechnology Center

### Entrepreneurial Ventures Action Team

- **Chair**: **Pam Lewis**, Co-Founder of Certified Entrepreneurial Community Program in WNC
- **Co-Chair**: **Robert B. Carton**, Ph.D., Chair, College of Business, Western Carolina University, Cullowhee
- **Gregory W. Cumberford,** President, Bent Creek Institute, Inc., Asheville
- **Richard Pigossi**, Founder & Chairman, Pegasus Capital, Asheville

### Later Stage BioBusinesses Action Team

- **Chair**: **Jack H. Britt**, Ph.D., Principle, Jack H. Britt Consulting, Etowah
- **Gregory Schulz**, President, Phenix Research Products, Inc., Candler
- **Zahed Subhan**, Ph.D., Director, Center for Entrepreneurship, Western Carolina University, Cullowhee

### Promotion and Branding Action Team

- **Chair**: **Paul V. Phibbs**, Jr., Ph.D., Emeritus Professor of Microbiology & Immunology, East Carolina University, Asheville
- **Co-Chair**: **Alan Escovitz**, Ph.D., Task Force on Integrative Health, Asheville Hub Alliance, Asheville
- **Jeffrey M. Hinshaw**, Ph.D., Professor and Extension Specialist, NC State University, Mills River
- **Thomas E. Meigs**, Ph.D., Associate Professor, Biology, University of North Carolina at Asheville
- **Steven W. Seagle**, Ph.D., Professor, Biology, Appalachian State University, Boone

**EVALUATION OF DONATED* TIME/SERVICES TO THE NC BIOTECHNOLOGY CENTER**

***ESTIMATES FOR FY 2013***

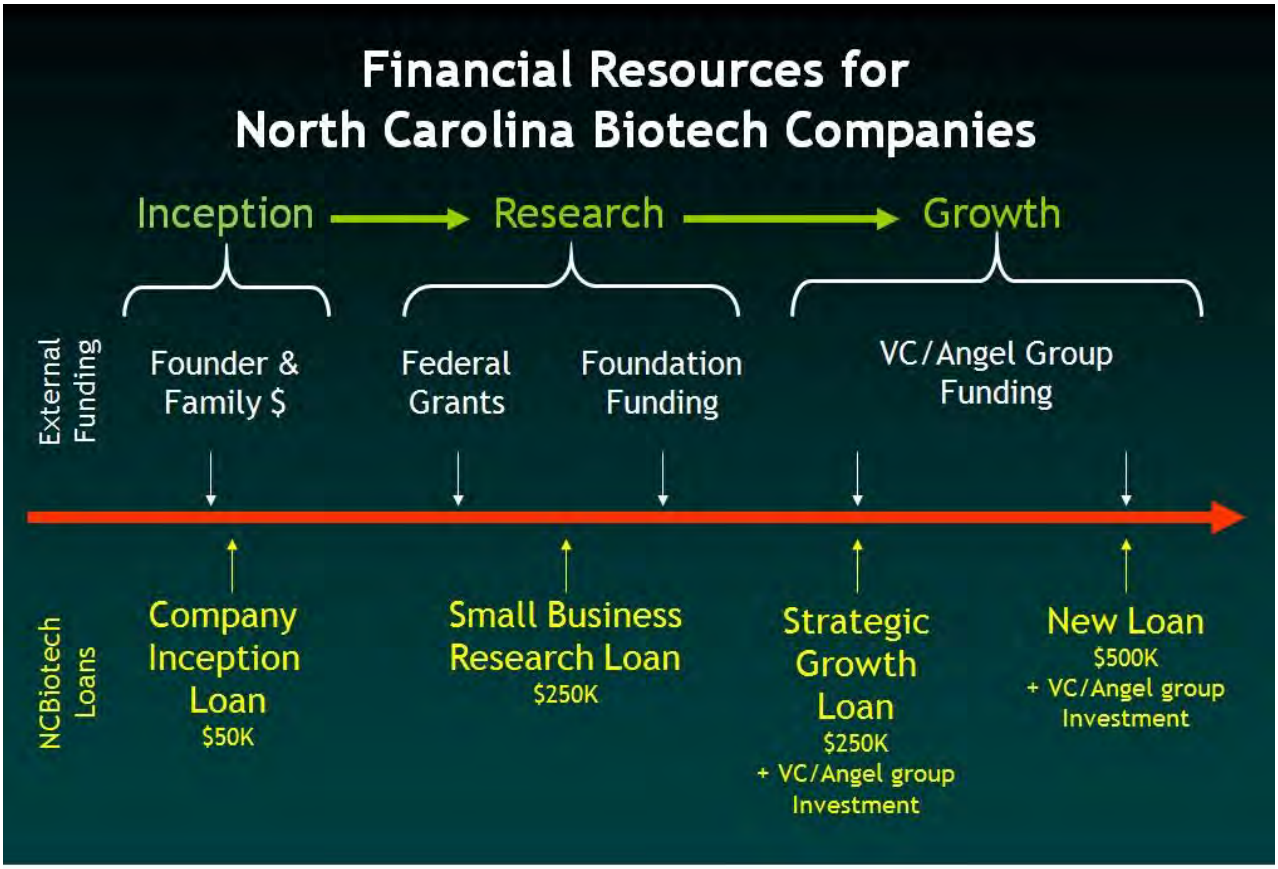
| | 1082 | 9987 | $ 642,560 | $ 1,837,760 |
|---|---|---|---|---|
| | total persons | total person hrs | total $ value range | |
| **ACTIVITY TYPE** | **# PERSONS** | **TOTAL PERSON HRS** | **$ VALUE RANGE (LO-HI)** | |
| Board of Directors | 37 | 300 | $ 30,000 | $ 150,000 |
| Board Committees | 48 | 375 | $ 37,500 | $ 187,500 |
| Regional Offices: Advisory Committees and Action Teams | 98 | 2313 | $ 231,300 | $ 1,156,500 |
| Regional Offices: Leadership for Regional Exchange Groups (REG) and Special Projects | 219 | 2783 | | $ 139,150 |
| Regional Offices: REG Speakers/Presentations | 83 | 580 | | $ 29,000 |
| Proposal reviewers (grants) | 285 | 751 | | $ 37,975 |
| Intellectual Exchange Group (IEG) Steering Committees | 90 | 1173 | | $ 58,250 |
| IEG Speakers/Presentations | 124 | 744 | | $ 37,200 |
| Teacher Workshops Speakers/Presentations | 41 | 99 | | $ 4,950 |
| AgBiotech Advisory Council and workgroups | 54 | 520 | | $ 32,000 |
| Interns and Field Experiences | 3 | 349 | | $ 5,235 |

* These figures do not include those persons who received honorariums or other compensation other than food or travel reimbursement.

# Biotechnology Center Loan Programs
**(NC-Based Companies Are Eligible for Loans)**

| Loan Program | Maximum Amount | Purpose |
|---|---|---|
| Company Inception Loan | $50,000 | Funds company inception and related activities critical to company start-up |
| Small Business Research Loan | $250,000 | Funds company research & development on a product with commercial potential |
| Strategic Growth Loan | $250,000 (matched by a qualified investment group or partner) | Provides funding to enable companies to reach key milestones required to access institutional or partner funding |
| New Loan* | $500,000 | Provides additional company funding to complete major studies leading to major institutional or partner funding |

*To be implemented with expansion in loan budget for fiscal year 2015



# Additional Information Regarding Loan Follow-On Funding Data

| | |
|---|---|
| Number of companies to which NCBC has awarded loans | 154 |
| Number of loans NCBC has awarded to companies | 222 |
| Total amount of loans NCBC has awarded to companies | $25,103,572 |
| Number of subsequent funding events to these companies | 841 |
| Total amount of subsequent funding to these companies (excluding post-IPO activities) | $2,944,966,235 |
| Total amount of subsequent funding to these companies for every $1 in NCBiotech loan awards | $117.31 |

APPENDIX N

# Grant and Loan Programs

| GRANTS | PURPOSE | MAXIMUM AWARD |
|---|---|---|
| ***Business and Technology Grants*** | | |
| Technology Enhancement Grant (TEG) | Funding available to NC universities and research institutions through their respective technology transfer offices which supports research studies designed to generate data critical to advancing licensing discussions with a commercial partner. | $50,000 |
| ***Science and Technology Grants*** | | |
| Biotechnology Research Grant (BRG) | Funds innovative individual investigator research in targeted areas. | $100,000 |
| Collaborative Funding Grant (CFG) | Supports a university-company partnership by providing funding for a post-doctoral fellow or technician in a university laboratory who will conduct research on a project of commercial interest. | $100,000 |
| Institutional Development Grant (IDG) | Funds core equipment/facility used by multiple faculty. | $200,000 |
| ***Meeting and Event Grants*** | | |
| Biotechnology Event Sponsorship (BES) | Supports North Carolina-based events. | $2,000 |
| Biotechnology Meeting Grant (BMG) | Supports North Carolina-based events with a national or international focus. | $7,500 |
| **LOANS** | | |
| Company Inception Loan (CIL) | Supports business inception and related activities that are critical to the early-stage start-up of a company. | $50,000 |
| Small Business Research Loan (SRL) | Assists companies by supporting applied research critical to the development of products, processes, or tools with clear commercial potential. | $250,000 |
| Strategic Growth Loan (SGL) | Matches Biotechnology Center loan support with angel group or venture capital investments to fund biotechnology companies that have already established technical proof-of-concept and require further corporate development support. *A maximum of two SGLs allowed per company.* | $250,000 |
| **SPECIAL PROGRAMS** | | |
| Centers of Innovation (COI) | Funds that create a new entity to focus on accelerating the growth of targeted, biotechnology-related industry sectors by addressing commercialization obstacles *(by invitation only).* | |

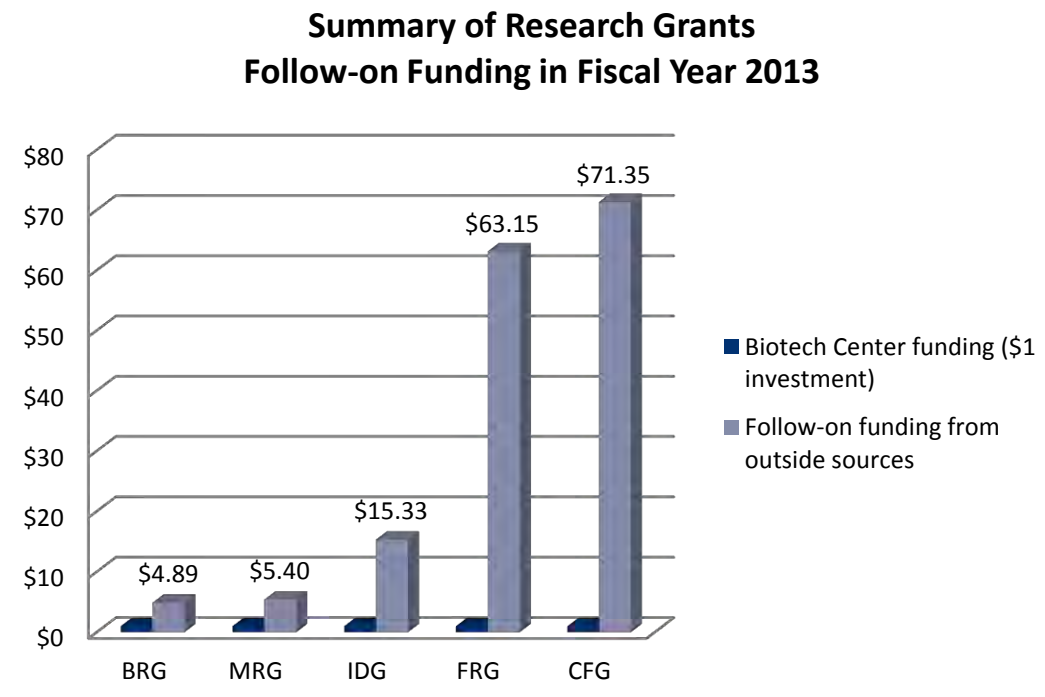
Additional information is available at *www.ncbiotech.org/grants* and *www.ncbiotech.org/loans*.

**North Carolina Biotechnology Center |** 15 T.W. Alexander Drive • P.O. Box 13547
Research Triangle Park, NC 27709-3547• 919-541-9366

## Follow-on Funding Data for Research Grants

Follow-on funding is tracked only for closed grants, and funding is only counted if it directly relates to the original program of study. All related money that comes into the PI's lab or university (i.e., both the direct and indirect portion of grants) is counted as follow-on. However, funding from the PI's institution or further funding from the Center is NOT counted. Funding to companies founded by the award recipients around technology developed through the initial grant award may also be counted as follow-on. This funding may be in the form of venture capital, federal grants, and licensing deals (not revenue).

Differences in follow-on funding results are due to a variety of factors including **the history of the program**: the BRG is fairly new, while the IDG has been around since the early 1980s; **the stage of the research:** e.g., Collaborative Funding Grants (CFGs) are near commercialization and involve a company partner, Biotechnology Research Grants (BRGs) are at the smaller institutions and are earlier stage research; **the ease of collecting data and the type of data that can be included** are also big factors: e.g., the Institutional Funding Grant (IDG) is an equipment grant and follow-on includes multiple users of the equipment over several years for many research projects, while a BRG project typically involves a single researcher and tracks research that is project specific to the original project funded. In addition, there are less easily measured benefits to different programs; the BRG emphasizes research statewide at smaller institutions; the Multidisciplinary Research Grant (MRG) sought to stimulate collaborations across disciplines; the Faculty Recruitment Grant (FRG) measured lifetime achievement of an individual faculty recruit throughout their career in North Carolina. Although the follow-on rewards of the FRG are quite high, the expense to attract qualified candidates has escalated beyond the Center's budget and the program was suspended in 2010.



In addition to tracking follow-on dollars, the Center also tracks journal articles and book chapters published; companies formed or spun out; and patents that result from grant awards.

**Additional Follow-on Results of NCBiotech Program Awards**

| Program | Publications | Companies | Patents |
|---|---|---|---|
| **BRG** | **91** | **1** relocated company (from NJ to NC) | **-** |
| **CFG** | **296** | **5** companies formed | **49** |
| **FRG** | **3,112** | **9** companies formed | **99** |
| **IDG** | **990** | - | **3** |
| **MRG** | **178** | - | **1** |

## Additional Information on FY2014 Active Research Grant Programs

**Biotechnology Research Grant (BRG)**
Maximum Award: $100,000

Biotechnology Research Grants support novel research projects that have the potential to strengthen biotechnology research and development at academic and non-profit research institutions in the early stages of building their research capacity. Investigators at the main campuses of Duke, UNC-CH and NCSU are only eligible for this program in the Applied Agriculture and Food Safety focus area noted below.

Awards are intended to support the generation of preliminary data required to attract funding from other sources, with the ultimate goal of technology commercialization. Focus areas are selected to align with strategic interests of the State.

Focus Areas for 2013 - 2014 include:

- Biotechnology applications to Applied Agriculture and Food Safety
- Marine Biotechnology
- Nanobiotechnology
- Biotechnology Combination Medical Devices
- Biotechnology applications to Drug Discovery
- Biotechnology applications to Natural Products
- Biotechnology applications to Vaccine Development

Proposals are evaluated on:

- The potential for significant contribution to the development of biotechnology or of commercial products derived from biotechnology.
- The initiation of novel and innovative research. A project judged to represent a continuation of an established research program is not eligible.
- The need for seed-money funding
- Originality
- Scientific Merit
- Significance

**Collaborative Funding Grant (CFG)**
Maximum Award: $100,000

The Collaborative Funding Grant (CFG) is a program for Principal Investigators at a university or nonprofit research institution in partnership with a life science company that will advance a company's technology

toward the marketplace. This grant provides funds for a post-doctoral fellow or technician in a university or non-profit's lab to conduct research on a project of commercial interest. University investigators and companies first form the collaboration and then apply together through the university or non-profit.

The CFG is jointly sponsored by the Biotechnology Center and the Kenan Institute for Engineering, Technology and Science at North Carolina State University.

The CFG helps companies to gain valuable, cutting-edge research to advance their technology while also providing Principal Investigators at the university or non-profit to build relationships with companies that may lead to future support. In addition, post-doctoral researchers and technicians gain industry experience. Companies must meet specific guidelines for program eligibility.

This grant is designed to:

- Generate discoveries that the company partner might develop further to stimulate economic development and create jobs in North Carolina.
- Promote long term cooperation among North Carolina universities, nonprofit research institutes, and North Carolina biotechnology companies.
- Support research that will assist a company in reaching a commercially significant research milestone.

Proposals are evaluated on:

- Logical and technically feasible project plan.
- Value of project to move the company's technology towards commercialization and project's alignment with company's business plan.

**Institutional Development Grant**
Maximum Award: $200,000

The purpose of the Institutional Development Grant program is to provide research equipment or core facilities that serve multiple investigators. Research Extensive universities (UNC-CH, NCSU and Duke ) require at least six investigators; Non-research Extensive universities require at least three.

Proposals are evaluated on:

- New ideas that may lead to biotechnology breakthroughs
- The ability to strengthen regional and statewide biotechnology capabilities
- Context of an institutional initiative
- Strength of collaborations including those between academic and industrial scientists

Appendix/Figure 6c

Figure 6C lists examples of NCBiotech loan awardees that announced transformational events in calendar 2013. Early NCBiotech loans were integral to the growth of all of these companies (in fact, among the ten companies listed in Figure 6C, seven received their first outside funding from the Biotechnology Center).

**Figure 6C – Recent Loan Portfolio Company Successes**

| Company | NCBiotech Funding | 2013 News |
|---|---|---|
| Advanced Liquid Logic | $468,100 | Acquired by Illumina for $96 million |
| Aerial | $250,000 | Strong Phase 2 data for narcolepsy drug |
| BioKier | $375,000 | $1.7 million investment from Am. Heart Association and Broadview Ventures |
| bioMASON | $25,000 | Won $670,000 Postcode Challenge; investment from Acorn Innovestments |
| Eboo Pharmaceuticals | $30,000 | $1.5 million grant from Michael J. Fox Foundation |
| G1 Therapeutics | $500,000 | $12.5 million investment from MedImmune Ventures and Hatteras Venture Partners |
| Grassroots Biotech. | $12,500 | Acquired by Monsanto for undisclosed amount |
| Heat Biologics | $225,000 | $26.0 million initial public offering |
| Novocor Medical | $37,500 | Winner of SEBIO Early-Stage Shootout; $961,000 in angel investments |
| Physcient | $149,739 | CED Venture Conference Best Pitch Winner; $869,000 in angel investments |

Reflecting the diversity of the industry sectors supported by the Biotechnology Center, the companies highlighted in Figure 6C operate in the diagnostics, therapeutics, medical devices, agricultural biotechnology and industrial biotechnology arenas.

## Figure 6D – NCBiotech Non-Funding Programs Key to Industry Growth

| Program | Description |
|---|---|
| NCBiotech VC Events* | NCBiotech-organized events in venture capital hubs to connect NC-based companies with VCs; for example, at the NCBiotech VC event in Boston, eight NC companies presented to VC groups that had raised $12 billion since 2006 (compared to only $600 million total for all NC-based life science VCs); events are sponsored by banks and law firms |
| NCBiotech's Annual Partnering Event | Connects NC-based companies and universities with larger companies seeking to in-license their products; the 2013 event welcomed 163 organizations, including 15 multinational companies and 30 investor groups |
| NCBiotech Pharma Partnering* | NCBiotech recruits multinational biopharma companies to visit NC and discuss collaborations with NC-based companies and/or academic centers that will accelerate innovation and job creation here; NCBiotech has hosted ten such programs in the past three years |
| Biotech Forums | Quarterly events organized in collaboration with CED to educate life science stakeholders on key industry topics and to cultivate networking and best practice-sharing among industry leaders |
| Venture Philanthropy Programs* | The VC industry's increased focus on later-stage companies has widened the early-stage funding gap; venture philanthropies (disease-focused foundations) have helped to fill that gap and NCBiotech has organized programs linking NC life science companies developing new products with foundations that are eager to bridge these products from research to commercialization |
| Crowdfunding Programs* | Another new way to fund early-stage life science companies is through crowdfunding; NCBiotech recently organized and moderated a program that attracted top officials from the nation's leading Ag Biotech and healthcare crowdfunding organizations |
| BATON | BATON is an online network of more than 400 NC-based service providers that have been vetted by NCBiotech and have agreed to provide services to emerging NC life science companies for sharply discounted fees |
| Angel Summit Lunches* | NCBiotech holds quarterly lunches that foster improved relationships between North Carolina-based angel capital groups, facilitate sharing of best-practices, create opportunities to syndicate deals, and provide a forum through which NCBiotech can introduce life science companies to the angel groups; a recent lunch resulted in significant angel group investments in a promising NC-based start-up |
| NCBiotech Jobs Network* | Monthly events to connect job seekers with new opportunities and to provide them tips for netting their next life science industry job |
| Life Science Business Development Professionals of NC | Regular LSBDP meetings provide an opportunity for NC-based business development professionals to share best practices and hear about key industry news and trends |
| NCBiotech Emerging Companies Preview | Annual event where early-stage NC-based life science companies present to a group of VCs and receive candid pitch feedback |
| NCBiotech Entrepreneur Essentials Events* | Seminar series to provide entrepreneurs with case study-driven, decision-enabling information to help them move their early life sciences companies forward |

| | |
|---|---|
| Intellectual and Regional Exchange Group Programs | NC Biotech supports 22 Exchange Groups across the state to foster networking/learning opportunities through informational seminars from local and national experts on a broad range of topics related to life science research, business, and economic issues |
| Exchanging Ideas Summit* | Annual event where the scientific and business communities come together for thought provoking presentations and networking |
| Grantsmanship Coaching | Informational handouts, web information, and workshop presentations at universities and non-profits across the state on best practices for proposal preparation are provided by Center staff to assist applicants; individual coaching and feedback are also provided |

*New programs created by NCBiotech in the past three years

# Biodefense and the NC Biotechnology Center

**Recommendations to President Tolson**
**6/21/13**

**Biodefense Team**
**Co-Chairs** Maria Rapoza and Mary Beth Thomas
**Members** Mark Phillips, Randall Johnson, and Sperry Krueger
**Advisors** Steve Casey, Susie Corbett

The Biodefense Team is a sub-team of NC Biotechnology Center's internal Strategic Opportunities Group. It began meeting to explore opportunities in biodefense for North Carolina, focusing on how best to advance and expand military and homeland defense-related biomedical research, development and commercialization activities in North Carolina.

North Carolina has tremendous strengths in the life sciences. It also has a significant federal investment given the large troop concentration located in the state. Despite these facts, NC has not historically been particularly strong in combining these two assets in a way that creates a biodefense sector.

This report from the Biodefense Team Chairs is intended to provide a broad definition of biodefense, background information, and recommendations for next steps to strengthen the biodefense sector in NC.

**Working definition of biodefense:**

In considering biodefense opportunities, NCBiotech has taken a broad view to include three areas of opportunity:

- Biodefense and emerging infectious diseases, including the detection of bioterrorist agents; development of countermeasures such as vaccines; protection of water, food, and energy supplies; and biohazard containment. BARDA activities and funding levels in this arena have grown significantly in size and scope, and warrant growing attention
- Department of Defense's extramural medical research program, which spans a wide range of biomedical areas such as cancer and traumatic brain injury (TBI), to combat casualty care and warfighter restoration.
- Veterans Administration R&D activities, since there is a well-developed network of medical research activities closely aligned with local universities and their industry partners.

This broader definition is strategically important, since it allows greater opportunity for synergy than a narrower definition would permit. Given that this effort is in its early stages of development, the Biodefense team believes that these are areas where NC has an identified asset or strength but is unsure which of these areas may hold the greatest opportunities. Should any one of these areas prove to be more productive than others, the Center can always narrow the initiative's focus at that time.

**Understanding the Landscape in NC**

*The military perspective*

Military and homeland biodefense development is a critical need for our nation and is also an area that has potential spillover impacts to other commercial areas of biosciences. North Carolina has numerous assets and areas of overlap that could provide support for several aspects of this critical need, but in many ways they are disconnected and underutilized.

North Carolina has major defense operations within the state including the third-largest military population in the US which is distributed among six military installations in NC such as Ft. Bragg, Camp Lejeune, and others. In addition, North Carolina is home to more than half of all US Special Operations Forces. North Carolina is also home to the Army Research Office, which administers its own funding programs as well as providing this type of support to other funding agencies including DARPA.

However, other than ARO, these operations are the 'point of the spear;' their focus is on training and operations rather than on research and development. Importantly, the Command structures that are responsible for the strategic decision making for medical and biodefense resources needed by DoD are *not* located in the State. And, in the words of the NC Military Foundation, 'There are very few roads that lead to NC, and DoD decision makers don't want to come here—so you have to go there (to the decision makers that are out of state).'

*The life sciences perspective*

North Carolina also has a strong life science sector. North Carolina's life science sector ranges from a strong bio-manufacturing base, to industrial service providers, to vibrant start-up companies, and a huge life science research enterprise at North Carolina's universities.

However, despite the massive life science research enterprise at North Carolina's universities, our universities have relatively low levels of DoD funding. A funding survey performed by the University of North Carolina's General Administration showed that, in FY 2012, funding from the DoD only accounted for 3.6% (or $33million) out of all of the federal funding received by the UNC System (a total of over $900 million). A primary reason for this is that there is little to no comfort level with the DoD funding process – a distinctly different funding mechanism than that used by the NIH. This has a trickledown effect to North Carolina's start-up companies who also do not receive much funding from DoD. Many of these companies come out of the university environment and therefore companies frequently do not have the expertise or relationships that are helpful in negotiating the DoD contracting stream.

The UNC System has recognized this issue and is to be commended for its work to address it through the Defense Applications initiative (described in more detail in their 2013 Strategic Directions Report). However, this type of change in the culture and expertise of the university is not easily achieved, and more resources would be welcome.

At this point in time, there are only two places where the life sciences and the military intersect in a significant way in North Carolina: in the VA hospital system which has a life science R&D component and the life science companies which have received funding from DoD funding agencies. However, there are obstacles to taking advantage of these assets. First, the VA hospital system is challenged by issues that are

beyond the scope of this brief report. And secondly, the level of DoD funding to NC life science companies is relatively low and the relationships with DoD are modest.

**Important Findings that Shape our Next Steps**

An analysis of DoD funding programs over the last year, involving many conversations and much research, has revealed two key findings that the Center must keep in mind as the initiative moves forward.

The first important finding is the 'solutions focus' of DoD funding programs. Working with the DoD begins with understanding their needs and working towards fulfilling them, rather than offering up research, products, and technologies that are not directed at solving a DoD problem.

The second important finding is the role of relationships in DoD awards. Despite the bureaucracy and process involved, DoD awards generally go to known partners and there is significant amount of repeat business. DoD particularly likes to work through its 'prime contractors' – large multinational corporations - who may then award subcontracts to smaller and more specialized entities. Unfortunately, there are few 'prime contractors' that have a presence in NC (an NCBiotech Library report on this topic is provided as an appendix.)

North Carolina does have several notable successes of life science companies that have received DoD funding. These examples include the major DARPA funding for Medicago that flows through ARO, which has a dedicated contractor overseeing the program; a recent DoD award to GSK for antibiotic research (not all of this goes to NC); and a large BARDA contract for the Novartis flu vaccine plant in Holly Springs. There are also numerous smaller companies that have received DoD funding. A different type of success is seen with Combat Medical Systems – a Fayetteville-based company that works to "simplify tactical medicine in order to decrease pre-hospital mortality." They do this by "providing and developing innovative products that simplify tactical medical care at every level." This innovative small business is a great example of a small life science company with an excellent understanding of the DoD needs and processes that is complemented by their strong DoD relationships.

NCBiotech can use these successes to develop a strategy to increase defense funding in North Carolina. Aligning NC's well-recognized strengths in the biotech sector with DoD strategic priorities presents some challenges because there is less geographic synergy and foundational relationships than might be expected. Our state is not as well positioned as others, particularly Maryland. However, there are assets that can be used to build on. Our recommendations are designed to take these challenges into account and take the sector to the next level.

**Recommendations:**

## *Level 1: With the resources currently available, the Center should do the following*

Recommended personnel needed:

- Maintain the current Biodefense team and add two new members – one from the Business and Technology group and one from the Agbiotech group. Establish quarterly team meetings to regularly discuss initiative.
- Maria Rapoza and Mary Beth Thomas will continue as co-chairs and will each formally designate ~15% of their time to the initiative.

Budgetary support – To date, activities for the Biodefense initiative have been supported out of the SOG budget. At Level 1, the recommendation is to continue to allocate funds to the SOG and continue to support the Biodefense initiative out of those funds.

Proposed priorities:

- ***Work with NC defense partners to maintain and strengthen relationships***
  - Maintain a standing team to build relationships and manage contacts within the NC defense community. This team should continue to strengthen and expand partnerships with other organizations focused on defense, including NC Military Foundation, ARO, Governor's Military Advisor, UNC System Defense Applications Group, and others.
  - Convene a summit of partners to discuss the Battelle report, *High Level Strategic Assessment for Advancing North Carolina in Military And Homeland Security Related Biomedical and Biodefense Activities*, these recommendations, and potential next steps for advancing biodefense efforts in NC
  - Engage the Business and Industrial development team and Corporate Communications to participate in appropriate events with partners, such as the 11th Annual Emerging Infectious Diseases and Biodefense Conference and the annual AUSA (Association of the United States Army) Conference, which has had a NC Commerce Pavilion

- ***Provide bio/biodefense-related resources to NC defense community and life science companies***
  - Maintain and update the defense asset database initiated by Sperry Krueger, NCBiotech Library.
  - Engage BTD and the Library when appropriate to target Center resources to specific companies with potential in the biodefense sector
    - One example - organize an NC Biotech Entrepreneurial Essentials event focused on introducing ARO program managers to the NC entrepreneurial community
  - Have the Library identify companies/people with a life science-related business or technology that are actively engaged with military/defense complex but not with NCBiotech
  - Create life science company case studies from the NC companies that are known to have achieved success by pursuing funding and engagement with DoD agencies that can serve as a roadmap or real world example of how this can be achieved. (start with Combat Medical Systems, Humacyte and Novan Therapeutics)

- ***Build a regional strategy to support biodefense statewide***
  - Work with the Regional Offices to raise the profile of what they currently do to support biodefense projects in their region. Examples include the Eastern office's work with ECU's Wounded Warrior and Operation Re-Entry programs, as well as DSM Dyneema, who contracts with the DOD.
  - Assist in formally assessing potential biodefense opportunities in the regions
  - One or more members of the Biodefense team will attend regional Advisory Board meetings in each region to present the Center's plan for expanding the biodefense sector in NC and gather input from regional stakeholders.
    - One example - North Carolina has a small but significant cluster of research and business in the combat medical sector. This sector seems to be of particular interest to Special Forces Operations. This sector should be targeted by the Regional Offices and Core Funding Programs.
  - Engage relevant regional stakeholders and other NC defense-related partners to become more familiar with the BRAC process and support NC's positioning by communicating our efforts to expand biodefense-related activities in NC.

## *Level 2: Recommendations for Expanded Activities*

The activities listed above are beneficial, and should be supported by Senior Management. Resources invested will be relatively modest, although these activities should certainly be considered in the planning of unit budgets and performance objectives. Although very worthy and important, these activities alone are not game changers.

In order to achieve a more significant level of progress, three different types of investment by the Center and the State are recommended. The recommendations listed below would require resources beyond those currently available.

These recommendations represent the work of the Biodefense Team and its Chair, combined with multiple synthesized discussions with key partners such as the Governor's Military Advisor John Nicholson, Ret. Gen. Hugh Overholt, UNC System Defense Applications Engineer Kathie Sidner, and the NC Military Foundation leadership, combined with the outcomes of the Battelle report.

Recommended personnel needed:

- Maintain the same personnel that was recommended in Level 1 (maintain the Biodefense team plus add two new members plus designate 15% of time from Maria Rapoza and Mary Beth Thomas)
- Add one new Center employee to focus on expanding business and defense relationships
- Potentially add a part-time contractor/lobbyist for VA activity

Budgetary support – the Biodefense initiative has previously been supported out of the SOG budget. For Level 2, the recommendation is to continue to allocate funds to the SOG to continue to support the Biodefense initiative out of those funds plus the addition of the following set-asides:

- $120,000 for the new full-time Director-level Center employee;
- $60,000 to support a lobbyist on behalf of the VA initiative;
- $50,000 to support a study by the UNC system to evaluate the possible opportunity for basing a UNC person at a federal R&D institution.

Proposed priorities:

***Develop and expand DoD/prime contractor/business relationships for NC***

- Bring more expertise into the Center with a new hire at the Director level with experience and contacts in the federal R&D life science defense sector. Specifically, this person would have both knowledge of the DoD contract and subcontract systems as well as knowledge and established relationships with prime contractors. This person should facilitate relationships between DoD's prime contractors and NC life science companies, who could be tapped to fulfill subcontracts.

***Expand VA R&D Activities in NC***

- Establish an initiative to grow the VA clinical and research presence in the State, in partnership with our congressional delegation. Engage a lobbyist to work closely with our Congressional delegation and meet with the Veterans Affairs sub-committee members to encourage expansion of the VA in NC

***Engage universities as strategic partner to advance the growth of life science DoD funding to NC universities***

As a first step in this process, the Center should partner with university administration to perform a study evaluating potential strategies. The most appropriate partner may be either the UNC System or an individual

university with a biodefense initiative (such as NCSU). Two specific strategies that should be included in this evaluation are raising the profile of NC universities at federal biodefense facilities and recruiting federal biodefense personnel to positions within university administration.

This study should also evaluate the various federal biodefense institutions as potential partners, where a stronger relationship with NC is feasible. Study would include visits to federal facilities and a determination of which may align with NC life science/biodefense strength areas.

**Strategy 1**: Raise the presence of NC at major federal biodefense facilities to advance partnerships and collaborative activities. This was a key recommendation from the Battelle report, *High Level Strategic Assessment for Advancing North Carolina in Military and Homeland Security Related biomedical and Biodefense Activities*. Many of the leading federal biodefense facilities are located in Maryland - not too geographically distant to prevent North Carolina universities interested in creating a presence that could leverage broader activities in the state.

- *Case Study:* Georgia Tech has already pioneered this model, with Georgia Tech Research Institute Field operations at Aberdeen Proving Ground.
- http://www.gtri.gatech.edu/aberdeen

**Strategy 2**: Recruiting high level life science R&D experts with experience in DoD research agencies to NC universities. This strategy would be along the lines of what has been observed with the hiring of Brett Giroir – former director of DARPA – by Texas A&M. Since joining Texas A&M as a Vice Chancellor, Dr. Giroir has been involved in more than ***$285.6M*** in public private partnerships involving federal biodefense initiatives, including the recent HHS Center for Innovation in Advanced Development and Manufacturing in partnership with GSK and others.

- *Case Study:* Brett Giroir was the Director of DARPA from 2006-2008.
  http://www.tamus.edu/about/exec/initiatives/

  http://news.tamus.edu/2012/07/23/ciadm-open-for-business/

Should it be determined by the study that a NC partnership with a federal agency would be beneficial; the Center could work closely with the University to create a set of programs that would support and enhance the selected strategies to enhance biodefense work in the university.
Such Biotech Center programs would be an important investment in strengthening North Carolina-DOD relationships through the university infrastructure.

Examples of new Center programs could include:

- Creating a targeted Center funding program to support a NC university person at a satellite campus co-located with the federal institution
- Creating a targeted Center funding program to support strategic faculty hire(s) with federal agency leadership experience. These new strategic hire(s) would join either the UNC System or one of North Carolina's main university campuses, where the institution has an existing biodefense initiative

# Appendix

## Top Awardees of DOD R&D Contracts—Prime and Subawards

Compiled by Susan Craft
North Carolina Biotechnology Center Library and Information Services
May 2013

**Top 10 DOD Contractors (2012):**

| Company/Organization | Total obligated amount |
|---|---|
| Lockheed Martin Corporation | 18,207,120,567 |
| The Boeing Company | 16,866,536,430 |
| General Dynamics Corporation | 9,251,114,086 |
| Raytheon Company | 7,399,711,191 |
| Northrop Grumman Corporation | 6,426,606,851 |
| L-3 Communications Holdings Inc. | 3,307,110,637 |
| Bae Systems PLC | 2,826,991,294 |
| Bell Boeing Joint Project Office | 2,615,380,693 |
| Triwest Healthcare Alliance Corp. | 2,525,801,510 |
| United Technologies Corporation | 2,512,453,816 |

**Top 20 DOD contractors (2011-2013) with product service codes in Life Sciences, Biomedical and AIDS Research:**

| Company/Organization | Total obligated amount |
|---|---|
| Battelle National Biodefense Institute, LLC | $211,151,200 |
| Dynport Vaccine Company Limited Liability Company | $126,725,636 |
| Avi Biopharma, Inc. | $68,987,313 |
| Lockheed Martin Corporation | $23,071,412 |
| Tekmira Pharmaceuticals Corporation | $18,103,366 |
| Goldbelt Raven LLC | $13,261,298 |
| Achaogen Incorporated | $12,037,087 |
| Regents Of The University Of Colorado, The | $6,988,579 |
| Science Applications International Corp. | $5,766,518 |
| Ibis Biosciences, Inc. | $5,674,542 |
| Research Foundation Of State University Of New York, The | $5,549,052 |
| Yale University | $5,130,735 |
| Bioprotection Systems Corporation | $3,388,914 |
| VaxDesign Corporation | $3,377,258 |
| Trius Therapeutics, Inc. | $3,107,430 |
| Miscellaneous Foreign Awardees | $2,964,919 |
| Trustees Of The University Of Pennsylvania | $2,709,470 |
| Texas A & M University System Health Science Center Research | $2,624,578 |
| InBios International, Inc | $2,140,005 |
| DME Alliance, Inc. | $2,105,585 |

**Top 20 DOD Sub-awardees (2011-2013) with NAICS code 541711 - Research and Development in Biotechnology:**

| Company/Organization | |
|---|---|
| Johns Hopkins University Applied Physics Laboratory LLC, The | $ 9,291,770 |
| Regents Of The University Of Michigan | $3,942,830 |
| Johns Hopkins University, The | $3,935,781 |
| University Of Pittsburgh The | $1,282,774 |
| Virginia Commonwealth University | $999,868 |
| Dearborn Group, Inc. | $926,258 |
| Donald Danforth Plant Science Center | $918,096 |
| Massachusetts Institute Of Technology | $846,592 |
| Trustees Of The University Of Pennsylvania | $846,586 |
| Lockheed Martin Corporation | $807,349 |
| Torrey Pines Institute For Molecular Studies, Inc. | $732,368 |
| J. F. Drake State Technical College | $707,000 |
| Teledyne Scientific & Imaging, LLC | $ 706,961 |
| Metron, Incorporated | $699,923 |
| Purdue University | $686,989 |
| Harvard College, President & Fellows Of | $500,522 |
| Texas Biomedical Research Institute | $500,402 |
| Nanotx Corp. | $488,097 |
| California Institute Of Technology | $460,000 |
| University Of San Francisco | $455,780 |

**Top 20 DOD Sub-awardees (2011-2013) with NAICS code 541712 - Research and Development in the Physical, Engineering and Life Sciences (except Biotechnology):**

| Company/Organization | |
|---|---|
| Sierra Nevada Corporation | $299,253,055 |
| L-3 Communications Corporation | $205,741,502 |
| Dynamic Aviation Group, Inc. | $86,642,298 |
| Fiber Optic Marketplace, LLC, The | $82,234,644 |
| Bae Systems Information And Electronic Systems Integration Inc. | $67,526,687 |
| CDW Corporation | $65,000,000 |
| Estuate, Inc. | $61,732,000 |
| Winchester Systems Inc. | $55,547,262 |
| Bae Systems PLC | $41,497,744 |
| Mcafee, Inc. | $32,868,007 |
| Apptis, Inc. | $31,456,106 |
| Raytheon Company | $27,060,916 |
| Modern Technology Solutions, Inc. | $21,436,395 |
| Aviation Systems Engineering Company, Incorporated | $18,883,150 |
| Volant Assoc LLC | $18,567,779 |
| Scitor Corporation | $18,056,511 |
| KEYW Corporation, The | $14,021,771 |
| Leland Stanford Junior University, The | $12,960,237 |
| Exponent, Inc. | $12,700,235 |
| Mustang Technology Group, L.P. | $12,675,543 |

# North Carolina Biotechnology Center

## Awards - Fiscal Years 2011, 2012 and 2013

July 1, 2010 - June 30, 2013

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| 2013 | | | |
| Biotechnology Event Sponsorship | | | |
| Appalachian State University | Coffey, Tonya S. | ASU Science Expo | $409 |
| Association of Clinical Research Professionals | Molek, Jill | The Changing Horizons of Clinical Research | $1,000 |
| Duke University | Grunwald, Ron | State of North Carolina Undergraduate Research and Creativity Symposium | $2,500 |
| Duke University Medical Center | Lad, Nandan | Inaugural RTP NeuroInnovations Symposium | $1,000 |
| Durham Technical Community College | Mancour, Laurin C. | AWARE for All - the Triangle, Clinical Research Education Day | $2,500 |
| East Carolina University | Zhang, Baohong | US-China Cotton Biotechnology Workshop | $3,000 |
| East Carolina University | McMillen, Brian A. | 14th Annual Neuroscience Research Day | $991 |
| East Carolina University | Soderstrom, Ken | 2012 Carolina Cannabinoid Collaborative Conference | $1,380 |
| North Carolina Association for Biomedical Research | Wilkison, Suzanne W. | Bridging the Gap: Uniting North Carolina K-16 STEM Education | $3,000 |
| North Carolina State University | Deiters, Alex | "Chemical Answers to Biological Questions", a Chemical Biology Symposium within the Southeast Regional Meeting of the American Chemical Society (SERMACS) | $1,500 |
| North Carolina State University | Kelly, Robert M. | 2012 Molecular Biotechnology Research Symposium | $1,500 |
| North Carolina State University | Nevzorov, Alexander A. | Joint Southeastern Magnetic Resonance Conference/Southeastern Regional Meeting of the ACS | $1,500 |
| North Carolina State University | Ashwell, Christopher M. | North Carolina State University Undergraduate Research Symposium | $990 |
| North Carolina State University | DiMeo, Andrew J. | 7th Annual Biomedical Engineering Symposium | $2,500 |
| UNC - Chapel Hill | Cordeiro-Stone, Marila | Careers in Toxicology Workshop | $3,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| UNC - Chapel Hill | Ashby, Valerie S. | North Carolina Alliance to Create Opportunity Through Education (NC OPT-ED) Eleventh Annual Alliance Day Conference | $1,500 |
| UNC - Chapel Hill | Brennan, Jennifer | Genome Sciences Building Opening Symposium | $2,000 |
| UNC - Chapel Hill | Kuhlman, Brian | 3rd Annual Biochemistry and Biophysics Research Retreat | $2,000 |
| UNC - Chapel Hill | Napier, Mary | The Tar Heel Innovation Challenge (THInC) | $1,000 |
| UNC - Chapel Hill | Maeda, Nobuyo | 2013 Integrative Vascular Biology (IVB) & UNC McAllister Heart Institute (MHI) Annual Research Symposium | $3,000 |
| UNC - Chapel Hill | Britt, Tara J. | Nexus of Gene Therapy and Regenerative Medicine | $1,341 |
| UNC - Chapel Hill | Hall, Joshua | NC DNA Day 2013 | $3,000 |
| UNC - Chapel Hill | Earp, H. Shelton | 37th Annual UNC Lineberger Comprehensive Cancer Center Symposium: The Tumor Microenvironment | $3,000 |
| UNC - Charlotte | Gross, Margo E. | North Carolina Chapter of the Society of Research Administrators International Annual Conference | $2,000 |
| UNC - Pembroke | Santisteban, Maria S. | 110th North Carolina Academy of Science Annual Meeting | $2,470 |
| Wake Forest University Charlotte Center | Benbow, Marjorie T. | Biotechnology & Innovation | $1,500 |
| Wake Forest University Charlotte Center | Johnson, Todd | Regenerative Medicine: Current Concepts and Changing Trends - Dr. Tony Atala | $1,800 |
| Total Biotechnology Event Sponsorship (27 items) | | | ***$51,381*** |
| Biotechnology Meeting Grant | | | |
| Duke University | Bates, Karl L. | ScienceWriters 2012 Conference | $10,000 |
| North Carolina Association for Biomedical Research | Wilkison, Suzanne W. | 2013 Media Training & Communications Program | $8,600 |
| North Carolina Center of Innovation for Nanobiotechnology | Ossey, Graeme A. | Nanomanufacturing Conference | $5,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Kundahl, Griffith A. | Nanotech Commercialization Conference | $10,000 |
| North Carolina Section of the American Chemical Society | Goss, Charles A. | 2012 Southeastern Regional Meeting of the American Chemical Society (SERMACS 2012) | $5,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| North Carolina State University | Narayan, Roger J. | 2012 North Carolina Tissue Engineering and Regenerative Medicine Conference and Innovation Summit | $2,500 |
| ScienceOnline | Traphagen, Karyn | ScienceOnline2013 | $8,000 |
| Society For Translational Oncology, Inc. | Murphy, Ann | 3rd Annual Meeting of the Society for Translational Oncology Hosted by UNC Lineberger: "Personalizing Cancer Diagnosis and Treatment 2012" | $5,000 |
| UNC - Chapel Hill | Ahalt, Stanley | The National Consortium for Data Science (NCDS) Leadership Summit: Genomes to Health | $3,000 |
| UNC - Charlotte | Gibas, Cynthia J. | 9th Annual International Symposium on Bioinformatics Research and Applications (ISBRA) | $8,970 |
| Wake Forest University | Preslar, Len B. | 4th Annual Wake Forest University Biotech Conference and Case Competition | $6,700 |
| Total Biotechnology Meeting Grant (11 items) | | | ***$72,770*** |
| Biotechnology Research Grant | | | |
| East Carolina University | Walters, Dianne M. | Genetic Susceptibility to Pulmonary Toxicity of Inhaled Carbon Nanotubes (Resubmission) | $100,000 |
| East Carolina University | Wiley, John E. | Autologous Tumor Cells Modified to Exhibit alpha-Gal Antigens as Anti-Cancer Vaccines (Resubmission) | $96,500 |
| North Carolina Central University | Xie, Jiahua (Jay) | Glycoengineering of Sialylation Pathway in Tobacco Plants for Expressing Humanized Recombinant Glycoproteins | $99,560 |
| North Carolina State University | Scott, Maxwell J. | Development of an Engineered Strain of Spotted Wing Drosophila (D. suzukii) Ideal for a Genetic Control Program | $99,870 |
| UNC - Greensboro | LaJeunesse, Dennis R. | Biomimetic Antifugal Surfaces | $100,000 |
| Total Biotechnology Research Grant (5 items) | | | ***$495,930*** |
| Collaborative Funding Grant | | | |
| Duke University Medical Center | Liedtke, Wolfgang B. | Transdermal Targeting of Pathological Pain by Enhanced Delivery Vehicles | $100,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| North Carolina State University | Brown, Allan F. | Gene Discovery and Diallel Analysis of Lutein Combining Ability in Broccoli | $95,525 |
| North Carolina State University | Loboa, Elizabeth G. | Development and Translation of Controlled Release "Smart Bandages" for Antimicrobial, Antibacterial, and Anti-Inflammatory Wound Healing Applications | $100,000 |
| North Carolina State University | Kim, Sung Woo | Novel Enzyme Applications to Reduce Anti-nutritional Compounds in Vegetable Diets Enhancing Their Use in Young Pigs | $100,000 |
| North Carolina State University | Lanier, Tyre C. | Development of Quality Assurance Specifications for Restructured, Raw Blue Crabmeat: Baseline Quality and Functionality Data Collection | $100,000 |
| North Carolina State University | Anderson, Kevin L. | Evaluation of a Rapid Blood Leukocyte Differential for Calf Health Management | $100,000 |
| UNC - Chapel Hill | Ramsey, John Michael | A Point of Care Microfluidic Device for Measuring HbA1c Using an Enhanced CE Separation | $100,000 |
| UNC - Chapel Hill | Grieger, Joshua C. | AAV Factor VIII Vector Construction for Hemophilia A Gene Therapy Applications | $100,000 |
| Total Collaborative Funding Grant (8 items) | | | ***$795,525*** |
| Company Inception Loan | | | |
| Ardeal Pharma, Inc. | Frisbee, Roger R | Ardeal Pharma CIL Loan Application | $50,000 |
| BaseTrace, LLC | Rudulph, Jake | BaseTrace Commercialization Capacity Development | $50,000 |
| Benson Hill Biosystems, Inc. | Crisp, Matthew B. | Benson Hill Biosystems Establishment and Preparation for Financing | $50,000 |
| Biodeptronix | Price, Christopher H. | Use of Living Human Cells to Sense and Monitor Airborne Pollutants and Other Chemicals That May Impact Human Health | $50,000 |
| bioMASON Inc | Dosier, Ginger M | bioMASON Business Development and Scaled Optimization Testing | $50,000 |
| Nova Synthetix, Inc. | Walters, Donald S | Nova Synthetix Company Inception | $50,000 |
| T3D Therapeutics, Inc. | Didsbury, John | T3D Therapeutics License Procurement and Financing | $50,000 |
| Total Company Inception Loan (7 items) | | | ***$350,000*** |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Center of Innovation | | | |
| NC Marine Bio-Technologies Center of Innovation | Mosca, Deborah A. | Marine Biotechnology Center of Innovation, Phase II Grant | $132,105 |
| NC Marine Bio-Technologies Center of Innovation | Mosca, Deborah A. | Marine Biotechnology Center of Innovation, Phase II, Bridge Funds | $150,000 |
| NC Marine Bio-Technologies Center of Innovation | Mosca, Deborah A. | Marine Biotechnology Center of Innovation, Phase II, Bridge Funds | $700,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Kundahl, Griffith A. | Phase II: Implementation Stage Funding- Bridge Funds | $50,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Kundahl, Griffith A. | Phase II: Implementation Stage Funding- Bridge Funds | $200,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Kundahl, Griffith A. | Phase II: Implementation Stage Funding- Transition Support | $350,000 |
| Total Center of Innovation (6 items) | | | ***$1,582,105*** |
| Economic Development Award | | | |
| Durham County | Ruffin, Mike | Economic Development - Project BV | $50,000 |
| Durham County | Ruffin, Mike | Economic Development - Project Dixie | $100,000 |
| Guilford County Administration | Garrett, Betty G. | Economic Development - Project Piedmont | $50,000 |
| Pitt County Development Commission | Yuhas, Wanda E. | Economic Development - Project Sequence | $50,000 |
| Total Economic Development Award (4 items) | | | ***$250,000*** |
| Education Enhancement Grant | | | |
| Bennett College | Gibson, Willietta | Enhancement of Biotechnology, Cell Biology and Genetics Courses at Bennett College | $87,565 |
| Cape Fear High School | Crandall, Whitney M. | Biotechnology and the Future of the Horticulture Industry | $26,591 |
| Duke University | Deshusses, Marc A. | Development of Bioenergy Laboratory Modules for Undergraduates | $83,038 |
| Durham Technical Community College Foundation | Ockert, Melissa O. | Development and Implementation of a Pharmacovigilance/Product Safety Program | $46,472 |
| East Carolina University | Christensen, Tim W. | A New Course in Genetic Engineering and Fermentation Technology (resubmission) | $36,322 |
| Elon University | Niedziela, Linda M. | Enhancements to New Biotechnology/Molecular Biology Degree Track in the Biology Department at Elon University | $7,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Gaston Day School | Byford, Anne M. | Biotechnology Driven AP Biology | $6,100 |
| North Carolina State University | Brown, Allan F. | Blueberry Genomics: Undergraduate Education for North Carolina Biotechnology (resubmission) | $82,247 |
| Polk County High School | Zalevskiy, Sergey | Exploring Biofuels | $24,000 |
| Wake Technical Community College | Vasquez-Kool, Jorge | Enhancement of an Undergraduate Introductory Microbiology Course | $58,081 |
| Woodlawn School | Fitzgerald, Adah W. | Developing Biotechnology Labs to Complement Existing High School Biology Curricula | $5,630 |
| Total Education Enhancement Grant (11 items) | | | ***$463,046*** |
| Education & Training Workshop | | | |
| Campbell University | Bloom, Emily M. | Gear Up! The Global Explosion of Antibiotic Resistance, How It Affects Public Health and How We Can Change It | $11,469 |
| UNC - Asheville | Ward, Jennifer Rhode | Stem Cells: Their Sources, Therapeutic Uses and Societal Issues | $24,768 |
| UNC - Charlotte | Warner, Jennifer M. | Biotechnology Basics | $16,486 |
| UNC - Charlotte | Warner, Jennifer M. | Microbial Magic | $20,295 |
| UNC - Wilmington | Kubasko, Dennis S. | Introductory Biotechnology Workshop for High School Teachers at the University of North Carolina Wilmington | $25,220 |
| Total Education & Training Workshop (5 items) | | | ***$98,238*** |
| Institutional Development Grant | | | |
| Duke University Medical Center | Rockman, Howard A. | Echocardiography for Sophisticated Murine Cardiac Phenotyping (resubmission) | $194,002 |
| Duke University Medical Center | Dressman, Holly K. | Expression Profiling of Single Cells | $172,840 |
| Duke University Medical Center | Murdoch, David M. | Proposal for a Regional Dip Pen Nanolithography Capability | $150,000 |
| East Carolina University | Thomassen, Mary J. | Acquisition of a Confocal Laser Scanning Microscope to Enhance Research Infrastructure | $199,905 |
| Elon University | Moore, Victoria Del Gaizo | Acquisition of a Flow Cytometer for Interdisciplinary and Collaborative Use at Elon University (resubmission) | $35,156 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Friends of the NC Museum of Natural Sciences | Horvath, Julie E | Automated Pipetting System and Next Generation DNA Sequencer | $77,659 |
| North Carolina State University | Stone, Eric A. | Core Facility Expansion at NCSU with the MiSeq | $93,750 |
| UNC - Chapel Hill | Bautch, Victoria L. | Acquisition of an Olympus FV1200 Confocal Microscope Dedicated to Live Imaging (resubmission) | $200,000 |
| UNC - Chapel Hill | Machius, Mischa C. | Acquisition of a Douglas Instruments Oryx4 Crystallization System Dedicated to Microseed Matrix Screening | $41,164 |
| UNC - Chapel Hill | Chavala, Sai H. | Micron III Imaging System to Advance Stem Cell, Gene Therapy, and Angiogenesis Research at the University of North Carolina-Chapel Hill | $199,000 |
| UNC - Chapel Hill | Hinderliter, Alan L. | Acquisition of a Research Cardiovascular Ultrasound Imaging System (resubmission) | $141,363 |
| UNC - Chapel Hill | Magness, Scott T. | Acquisition of the Fluidigm C1 AutoPrep System for Single Cell Gene Expression Analysis | $146,228 |
| Wake Forest University Health Sciences | Hawkins, Gregory A. | Pyromark Q96 MD | $115,113 |
| Winston-Salem State University | Kump, David | Acquisition of the EchoMRI 4-in-1 Body Composition Analyzer | $119,840 |
| Total Institutional Development Grant (14 items) | | | ***$1,886,020*** |
| Industrial Fellowship Program | | | |
| Advanced Liquid Logic, Inc | West, Richard M. | Industrial Fellowship Support - Peter Ross - Year 1 | $42,000 |
| Bayer CropScience | Lawhon, Meredith | Industrial Fellowship Support - Jessica Monserrate - Year 1 | $37,000 |
| Gentris Corporation | Bordeaux, Dawn | Industrial Fellowship Support -Mukund Patel - Year 1 | $42,000 |
| GlaxoSmithKline | Crowder, Timothy | Industrial Fellowship Support - Dana Peles - Year 2 | $38,560 |
| KeraNetics LLC | Westmoreland, Kim | Industrial Fellowship Support - Erin Falco - Year 2 | $48,560 |
| Liquidia Technologies | Gordon, Florina | Industrial Fellowship Support - Katherine Horvath - Year 2 | $43,560 |
| Parion Sciences | Thelin, Bill | Industrial Fellowship Support- Diane Villalon - Year 2 | $48,560 |
| PharmAgra Labs, Inc. | Frisbee, Roger R | Industrial Fellowship Support - Sudarshan Upadhya - Year 1 | $47,000 |
| SePRO Corporation | Bunnell, Todd | Industrial Fellowship Support - Jessica Koczan - Year 2 | $43,560 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Total Industrial Fellowship Program (9 items) | | | ***$390,800*** |
| Industrial Internship Program | | | |
| Aerial Biopharma LLC | Powell, Margaret B | Industrial Internship Support - Brant Segura | $3,000 |
| Cell Microsystems, Inc. | Morrison, Chris | Industrial Internship Support - Jeffrey Harris | $3,000 |
| KeraNetics LLC | Johnson, Todd | Industrial Internship Support - Dana Upton | $3,000 |
| LipoScience, Inc. | Werk, Thomas A | Industrial Internship Support - Prerna Pherwani | $3,000 |
| North Carolina Biosciences Organization | Malloy, Jennifer M. | Industrial Internship Support - John Thayer | $3,000 |
| SciKon Innovation, Inc. | McClelland, Randy | Industrial Internship Support - Hobie Helbich | $3,000 |
| Shure Foods, Inc | Dough, William Gabriel | Industrial Internship Support - Don Schools | $3,000 |
| Teraffinity Inc. | Addison, Edwin R | Industrial Internship Support - Smita Kataria | $3,000 |
| Total Industrial Internship Program (8 items) | | | ***$24,000*** |
| Multidisciplinary Research Grant | | | |
| Duke University Medical Center | Palmer, Gregory M. | Imaging, Modeling and Modulating the Role of Myeloid Cells in Tumor Growth and Therapy | $300,000 |
| North Carolina State University | Ghiladi, Reza A. | A Novel and Potentially High Impact Approach for Wood Deconstruction: Deriving Cellulose for Biofuel Production from Lignocellulosics (Resubmission) | $270,061 |
| UNC - Chapel Hill | Bergmeier, Wolfgang | Multidisciplinary Approach to Study the Cal DAG-GEFI/Rap 1 Signaling Module in Platelets | $300,000 |
| UNC - Chapel Hill | Jones, Corbin D. | Developing REA (Repetitive Element Assembler) Algorithm for Assembling Repetitive and Hypervariable Genetic Elements (Resubmission) | $260,056 |
| UNC - Chapel Hill | Tarran, Robert | Development of Novel Peptides to Treat Diseases of Na+ Absorption (Resubmission) | $300,000 |
| UNC - Greensboro | Wasserberg, Gideon | Development of an Oviposition Attractive Blend for the Surveillance and Control of the Sand Fly Phlebotomus papatasi, the Vector of Old-world Zoonotic Cutaneous Leishmaniasis | $300,000 |
| Total Multidisciplinary Research Grant (6 items) | | | ***$1,730,117*** |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Presidential Initiative Award | | | |
| Durham County | Welton, Marqueta | Support for Durham County to Attract/Expand Medicago Biologics Manufacturing Facility | $50,000 |
| UNC - Chapel Hill Institute of Marine Sciences | Elmore, Vickie C. | Training Workshops at Molecular Training Facility in Eastern North Carolina | $40,000 |
| Total Presidential Initiative Award (2 items) | | | ***$90,000*** |
| Regional Development Grant | | | |
| Asheville-Buncombe Technical Community College | Gualandi, Richard J | Western North Carolina Craft-Beverage Quality Control Initiative | $75,000 |
| Bent Creek Institute, Inc. | Vickers, Amanda J. | Contract Formulation Services at USBSL | $75,000 |
| The Southeastern Partnership II, Inc. | McKoy, Marie A. | Biorenewable Biotechnology Asset Inventory - Southeastern North Carolina | $30,000 |
| UNC - Wilmington | Watanabe, Wade O. | Establishing Foundational Resources for Finfish Mariculture Business and Industry Development in North Carolina: Sustainable Feeds, Regional Feed Suppliers, and Enhanced Market Value | $74,991 |
| Total Regional Development Grant (4 items) | | | ***$254,991*** |
| Strategic Growth Loan | | | |
| BioKier, Inc. | Nolan, Roger D. | Comparative Study of the Effect of Single-Dose Treatment with Butyrate or L-Glutamine on Secretion of Gut Hormones in Type 2 Diabetes Subjects (Study Number IFD-101-CL3-001) | $250,000 |
| Clearside Biomedical, Inc | Deignan, Charles A. | Clearside Biomedical, Inc - Phase I/II Clinical Study | $250,000 |
| G1 Therapeutics | Black, Claudia A | Preclinical Development of GZ30-1, A Novel Chemoprotectant | $250,000 |
| Total Strategic Growth Loan (3 items) | | | ***$750,000*** |
| Small Business Research Loan | | | |
| Aerial Biopharma LLC | Khayrallah, Moise A. | Aerial Biopharma, LLC - Clinical Trial Protocol ADXN05 - 202 | $250,000 |
| CertiRx Corporation | Mercolino, Thomas J | GMP-like Manufacturability Study of On-dose Anticounterfeiting Technology | $247,270 |
| Galaxy Diagnostics, Inc. | Elam, Amanda B. | New Tests for Emerging Pathogens Linked to Chronic Disorders | $75,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Novametics | Strenkowski, John A. | Novametics Clinical Trials | $72,950 |
| Novocor Medical Systems, Inc | Voiers, Anthony S | Novocor Commercial Prototype Development | $75,000 |
| Oncotide Pharmaceuticals | Christensen, Dale J. | Preliminary IND-enalbing Studies of OP449 as a Novel Cancer Therapeutic | $250,000 |
| Physcient, Inc. | Crenshaw, Hugh C. | Advanced Prototype Development of the Physcient Dissector | $249,478 |
| Qualiber, Inc | Goyal, Anil K. | Development of Targeted Nanoparticle, NanoGTP, a More Effective Treatment for Pancreatic and Lung Cancer | $75,000 |
| Total Small Business Research Loan (8 items) | | | ***$1,294,698*** |
| Technology Enhancement Grant | | | |
| Duke University | Berger, Henry | GoFlo: Multi-well Flow Chamber System for Drug Toxicity Testing | $50,000 |
| UNC - Chapel Hill | Parsons, Kelly | Fluorogenic Sensors for Phospholipase C Isozymes | $50,000 |
| Total Technology Enhancement Grant (2 items) | | | ***$100,000*** |
| Undergraduate Biotechnology Research Fellowship | | | |
| Appalachian State University | Burris, Jennifer L. | Collagen Network Synthesis and Characterization via Scanning Electron Microscopy and Surface Enhanced Raman Spectroscopy (Jenna Osborn) | $5,000 |
| Appalachian State University | Burris, Jennifer L. | Development of a Raman Spectroscopy Membrane Thermometer for the Characterization oMmetallic Nanoparticles used for Cancer Therapy (Angela Chang) | $5,000 |
| Appalachian State University | Burris, Jennifer L. | Development and Testing of a Raman-Tweezers Apparatus (Jessica Barrios-Hernandez) | $5,000 |
| East Carolina University | Farwell, Mary A. | Undergraduate Biotechnology Research Fellowship in Toxicology (Joseph Ryan Rolli) | $5,000 |
| Elizabeth City State University | Rousch, Jeffrey M. | Biotechnology Careers Preparation -- Mass Culture Conditions of Commercially Relevant Cells and Their Bioremediation Potential (Ms. Kristal Grant) | $5,000 |
| North Carolina State University | Ashwell, Christopher M. | The Role of Phosphatidylinositol 4,5-bisphospate in the Regulation of Cotton Fiber Development (Peter Svizeny) | $5,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| North Carolina State University | Ashwell, Christopher M. | Expression Analysis and Silencing of a Polyketide Synthase in Mycosphaerella fijiensis, Causal Agent of the Black Sigatoka Disease of Banana<br>(Morgan Carter) | $5,000 |
| UNC - Asheville | Ward, Jennifer Rhode | Using Biotechnology to Conserve and Restore an Ecologically-Important Threatened Shrub in Western North Carolina<br>(Kristin Emery) | $5,000 |
| UNC - Charlotte | Brown, Banita W. | Antibody Mediated Targeting of Nanoparticles to MUC1 Expressing Pancreatic Cancer Cells<br>(Hoahiep Nguyen) | $5,000 |
| Western Carolina University | De Silva, Channa R. | Toxicological Assessment of Metal-based Nanomaterials with Potential Biomedical Applications<br>(Kortney L. Schumann) | $5,000 |
| Western Carolina University | Kwochka, William | Optimization of Drying Formulations and Microwave Processing Methodology for the Dry Preservation of Biologics (Elicha Benfield) | $5,000 |
| Total Undergraduate Biotechnology Research Fellowship (11 items) | | | ***$55,000*** |
| Total 2013 (151 items) | | | **$10,734,621** |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| 2012 | | | |
| Biotechnology Event Sponsorship | | | |
| Association of Clinical Research Professionals | Moser, Ro | Building Quality in Clinical Research | $1,000 |
| David H. Murdock Research Institute | Ghelani, Sheetal P. | 2nd Annual TRIMR Symposium | $1,000 |
| Duke University | Cullen, Bryan R. | Symposium on RNA Biology IX: RNA Tool and Target | $1,500 |
| Duke University | Zuiker, Anton J. | ScienceOnline 2012 | $2,500 |
| East Carolina University | Farwell, Mary A. | State of North Carolina Undergraduate Research and Creativity Symposium: SNCURCS 2011 | $1,000 |
| East Carolina University | O'Brien, Maryellen | The Society of Research Administrators, North Carolina Chapter (NCSRA) 17th Annual Conference -- Beyond Survival: Transformers of Tomorrow | $1,200 |
| Kannapolis City Schools | Boyd, Ellen D. | Kannapolis City Schools Biotechnology Academy Grand Opening | $1,500 |
| North Carolina Academy of Science, Inc. | Guzman, Karen | 109th Annual Meeting of the North Carolina Academy of Science | $1,500 |
| North Carolina Association for Biomedical Research | Wilkison, Suzanne W. | IACUC 2012 | $3,000 |
| North Carolina State University | Schenkman, Laura R. | 2011 Molecular Biotechnology Research Symposium | $1,500 |
| North Carolina State University | Day, Judy B. | North Carolina State University Undergraduate Research Symposium 2012 | $990 |
| North Carolina State University | DiMeo, Andrew J. | 6th Annual Biomedical Engineering Symposium | $1,000 |
| Technology Partnership of Nagoya University, Inc. | Azama, Kishu | Regenerative Medicine Roundtable | $1,500 |
| UNC - Chapel Hill | Ashby, Valerie S. | 2011 North Carolina Alliance to Create Opportunity Through Education (NC OPT-ED) Tenth Annual Alliance Day Conference | $1,000 |
| UNC - Chapel Hill | Goldstein, Bob | Molecular Mechanisms of Endocytosis Event | $800 |
| UNC - Chapel Hill | Goldstein, Bob | Microtubules and Cellular Functions Event | $1,000 |
| UNC - Chapel Hill | Maeda, Nobuyo | Integrative Vascular Biology (IVB) and UNC McAllister Heart Institute (MHI) Annual Symposium | $1,500 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| UNC - Chapel Hill | Caron, Kathleen | 2nd Annual Oliver Smithies Nobel Symposium - Presentation by Invited Nobel Laureate, Thomas Cech, PhD | $1,500 |
| UNC - Chapel Hill | Hall, Joshua | North Carolina DNA Day 2012 | $3,000 |
| UNC - Chapel Hill | Segal, Richard L. | First Annual UNC-NCSU Rehabilitation Engineering Symposium: Engineering a World Class Rehabilitation Center | $1,334 |
| UNC - Chapel Hill | Earp, H. Shelton | The 36th Annual UNC Lineberger Comprehensive Cancer Center Symposium - Cancer Therapies and New Drug Targets | $3,000 |
| UNC - Charlotte | Montague, Jennifer | Greater Charlotte Region Life Sciences and BioEngineering Graduate Student Career Symposium | $1,000 |
| Wake Forest University Health Sciences | Yoo, James J. | 13th Annual North Carolina Tissue Engineering and Regenerative Medicine Society (NCTERMS) Conference | $1,500 |
| Total Biotechnology Event Sponsorship (23 items) | | | ***$34,824*** |
| Biotechnology Meeting Grant | | | |
| Duke University Medical Center | Gregory, Simon G . | Duke Bioinformatics Workshop | $3,000 |
| Forsyth Technical Community College | Read, Russel H. | Toward Certification and Career Pathways in the Biosciences | $7,500 |
| ibiliti | Poorboy, Ann E. | medtech 11 | $5,000 |
| North Carolina Agricultural Foundation, Inc. | Maxwell, Catherine J. | Stewards of the Future: Research for Human Health and Global Sustainability | $5,000 |
| North Carolina Association for Biomedical Research | Wilkison, Suzanne W. | The 3 I's (IACUCs, IBCs, IRBs) and Bioethics: Animals, Humans, Science & Society -- Building a Culture of Trust and Shared Responsibility | $5,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Faulconer, Laura S. | Commercialization of Micro-Nano Systems Conference 2011 (COMS 2011) | $5,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Ossey, Graeme A. | Nanotechnology Commercialization Conference | $5,000 |
| North Carolina State University | Lila, Mary Ann | 6th International Workshop on Anthocyanins, 2011 (IWA2011) | $4,000 |
| UNC - Chapel Hill | Church, Frank C. | 6th International Symposium on the Chemistry and Biology of Serpins | $3,000 |
| UNC - Greensboro | Schmitz, Randy | ACL Research Retreat VI | $2,500 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Wake Forest University | Preslar, Len B. | Wake Forest Schools of Business Biotechnology Conference | $2,500 |
| Total Biotechnology Meeting Grant (11 items) | | | ***$47,500*** |
| Biotechnology Research Grant | | | |
| East Carolina University | Zhu, Yong | Developing a Method to Control Invasive Animals through Biotechnology | $75,000 |
| East Carolina University | Virag, Jitka A.I. | Intramyocardial EphrinA1-Fc Reduces Myocardial Infarct Injury (Resubmission) | $75,000 |
| UNC - Charlotte | Nesmelova, Irina V. | Towards Rational Engineering of Transposon-based Genetic Tools | $75,000 |
| UNC - Greensboro | Kepley, Chris | Identification and Validation of Novel Therapies for the Inhibition of Atherosclerotic Plaque Lesions | $74,938 |
| Western Carolina University | Bose, Indrani | Using RNA Interference to Identify New Drug Targets in the Human Pathogenic Fungus, Cryptococcus neoformans | $70,586 |
| Total Biotechnology Research Grant (5 items) | | | ***$370,524*** |
| Collaborative Funding Grant | | | |
| North Carolina State University | Jameel, Hasan | Characterization of Lignin in Non-woody Biomass to Improve Hydrolysis | $100,000 |
| North Carolina State University | Zeng, Zhao-Bang | Multiple Interval Mapping with Epistasis and Marker-Assisted Predictive Breeding | $100,000 |
| North Carolina State University Mountain Horticultural Crops Research & Extension Center | Ranney, Thomas G. | Development and Commercialization of "Carolina" Dogwoods | $100,000 |
| UNC - Chapel Hill | Zeisel, Steven H. | Choline Mediated Signaling and Brain Development | $100,000 |
| UNC - Chapel Hill | Singleton, Scott F. | Novel Potentiators of Fluoroquinolones for Gram-negative Pathogens | $100,000 |
| Wake Forest University | Bonin, Keith D. | Accelerating Drug Discovery: On-chip Selection of DNA-Encoded Chemical Libraries | $100,000 |
| Total Collaborative Funding Grant (6 items) | | | ***$600,000*** |
| Company Inception Loan | | | |
| Cell Microsystems, Inc. | Morrison, Chris | Preparation for the Commercial Launch of the IsoRaft System | $30,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Eboo Pharmaceuticals Inc. | McNutt, Robert W. | Corporate Structure and Business Development | $30,000 |
| MxBiodevices, LLC | Thompson, Marilyn J | MxBiodevices, LLC, Diabetic Foot Ulcer Business Plan | $30,000 |
| Novametics | Strenkowski, John A. | Novametics Company Inception Loan | $30,000 |
| NovaTarg, Inc. | Batchelor, Kenneth W. | NovaTarg Corporate Foundation Enhancements | $30,000 |
| Total Company Inception Loan (5 items) | | | ***$150,000*** |
| Center of Innovation Planning Grant | | | |
| Duke University Medical Center | Ginsburg, Geoffrey S. | Personalized Medicine COI Planning Grant | $100,000 |
| Total Center of Innovation Planning Grant (1 item) | | | ***$100,000*** |
| Center of Innovation | | | |
| ibiliti | Clark, Cindy L. | Advanced Medical Technologies Center Phase II COI- Renewal Funding | $580,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Kundahl, Griffith A. | Phase II: Implementation Stage Funding- Renewal Funding | $700,000 |
| North Carolina Drug Discovery Center of Innovation | Ehrlich, Paula J. | Drug Discovery Center of Innovation Phase 2 Grant Renewal Funding | $300,000 |
| Total Center of Innovation (3 items) | | | ***$1,580,000*** |
| Economic Development Award | | | |
| Salisbury-Rowan Economic Development Commission | Van Geons, Robert M. | Economic Development - Project Protein | $100,000 |
| Town of Morrisville | Whitson, John | Economic Development - Project Ark | $100,000 |
| Total Economic Development Award (2 items) | | | ***$200,000*** |
| Education Enhancement Grant | | | |
| Appalachian State University | Cohen, Seth D. | Developing Biotechnology Through Fermentation Science at Appalachian State University C0-PI/Dr. Brett Taubman | $60,800 |
| Campbell University | Shin, I. Daniel | Bioanalytical Equipment for Student Training (BEST) | $58,880 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Duke University | Noor, Juliet K. F. | A Database for an Inquiry-based Molecular Evolution Laboratory Exercise for College Courses: Whither Art Thou Selection?<br>CO-PI/Dr. Mohamed Noor | $4,167 |
| Elizabeth City State University | Adedeji, Dolapo A. | Incorporation Of Laboratory Activities Into Genomics and Proteomics Course | $5,000 |
| Friends of the NC Museum of Natural Sciences | Flint, Christy | Genomics & Microbiology Investigate Lab at the Nature Research Center<br>CO-PI/Ms. Kimberly Kandros | $40,720 |
| North Carolina Association for Biomedical Research | Wilkison, Suzanne W. | "Rx for Science Literacy" K--12 Curriculum Expansion | $72,820 |
| North Carolina State University | Rabah, Ghada | Closing the Gap Between the Academic Chemistry Labs and the Biotechnology Market: Development of Bioanalytical Experiments for the Undergraduate Chemistry and Biochemistry Laboratories | $68,339 |
| Pitt Community College | Paine, Olga R. | Pharmaceutically-Driven Addition of Biotechnology Course at Pitt Community College | $19,137 |
| UNC - Asheville | Ward, Jennifer Rhode | Infusing Biotechnology into the Undergraduate Plant Sciences Curriculum<br>CO-PI/Dr. Jonathan Horton | $30,808 |
| UNC - Charlotte | Schlueter, Jessica A. | Genomic Technologies in Bioinformatics<br>CO-PI/Dr. Jennifer Weller | $58,670 |
| UNC - Pembroke | Smith, Rachel B. | Modernization of Organic Chemistry Laboratory Equipment and Curriculum<br>CO-PI/Dr. Cornelia Tirla | $62,641 |
| Total Education Enhancement Grant (11 items) | | | ***$481,982*** |
| Education & Training Workshop | | | |
| Appalachian State University | Johnson, Phillip E. | Bio-monitoring of Genetically Modified Organisms | $12,962 |
| North Carolina Central University | Oldham, Carla E. | Introductory Biotechnology Workshop for High School Teachers | $20,350 |
| North Carolina State University | Rose, Robert B. | Three Week Intensive Workshop in Molecular Biology for High School Teachers | $24,487 |
| UNC - Asheville | Ward, Jennifer Rhode | Stem Cells: Their Sources, Therapeutic Uses, and Fates | $21,816 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| UNC - Charlotte | Warner, Jennifer M. | Microbial Magic Workshop for Middle School Teachers | $20,790 |
| UNC - Charlotte | Warner, Jennifer M. | Biotechnology Basics Workshop for High School Teachers | $16,754 |
| UNC - Wilmington | Pyott, Sonja J. | Introductory Biotechnology Workshop for High School Teachers at the University of North Carolina Wilmington | $24,355 |
| Total Education & Training Workshop (7 items) | | | ***$141,514*** |
| Institutional Development Grant | | | |
| Appalachian State University | Puckett, Libby G. | Instrumentation for the Advancement of Multi-Disciplinary Research at Appalachian State University | $97,588 |
| Duke University | Liu, Yutao | Duke Acquisition of a Mid-range DNA Sequencer for Molecular Genomics Core | $101,000 |
| Duke University Medical Center | Farsiu, Sina | Ultrahigh-Resolution Adaptive Optics Optical Coherence Tomography/Scanning Laser Ophthalmoscopy System (resubmittal) | $200,000 |
| East Carolina University | Sutherland, John C. | Circular Dichroism Spectrometer for Characterization of Proteins and other Biomolecules in the Far and Vacuum Ultraviolet | $54,019 |
| UNC - Chapel Hill | Frye, Stephen V. | Acquisition of a Tecan EVO 200 Robotic Sample Processor for UNC-CH CICBDD | $200,000 |
| UNC - Chapel Hill | Fisher, Nancy C. | BC Gallios (TM) Flow Cytometer to Advance Microparticle Research at UNC Chapel Hill (resubmittal) | $136,000 |
| UNC - Chapel Hill | Kashuba, Angela | UPLC-MS/MS to Support Preclinical and Clinical Pharmacology Studies in HIV Treatment and Prevention | $200,000 |
| UNC - Chapel Hill | Superfine, Richard | Nanomanipulation System for Biomedical Research and Development | $165,473 |
| Wake Forest University Health Sciences | Lowther, W. Todd | Enhancement of X-ray Crystallography at Wake Forest Biotech Place | $199,720 |
| Western Carolina University | Wilson, Mark R. | Purchase of Applied Biosystems 3500 HID Genetic Analyzer to Establish DNA Sequencing Core Facility at Western Carolina University | $174,572 |
| Total Institutional Development Grant (10 items) | | | ***$1,528,372*** |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Industrial Fellowship Program | | | |
| CiVentiChem, LLC | Venepalli, Bhaskar | Industrial Fellowship Support - Joseph Kaloko - Year 2 | $48,560 |
| GlaxoSmithKline | Crowder, Timothy | Industrial Fellowship Support - Dana Peles - Year 1 | $37,000 |
| GrassRoots Biotechnology, Inc. | Eisner, Douglas A | Industrial Fellowship Support - Patrick Vincent-Pope - Year 2 | $48,560 |
| KeraNetics LLC | Westmoreland, Kim | Industrial Fellowship Support - Erin Falco - Year 1 | $47,000 |
| Liquidia Technologies | Gordon, Florina | Industrial Fellowship Support - Katherine Horvath - Year 1 | $42,000 |
| Metabolon, Inc. | Lynch, Todd S. | Industrial Fellowship Support - Meredith Brown - Year 2 | $43,560 |
| Oncoscope, Inc. | Gebhart, Steven | Industrial Fellowship Support - Benjamin Moody - Year 2 | $48,560 |
| Parion Sciences | Thelin, Bill | Industrial Fellowship Support - Diane Villalon - Year 1 | $47,000 |
| SePRO Corporation | Bunnell, Todd | Industrial Fellowship Support - Jessica Koczan - Year 1 | $42,000 |
| Zen-Bio, Inc. | Pieraccini, Peter | Industrial Fellowship Support - Sarah Compton - Year 2 | $48,560 |
| Total Industrial Fellowship Program (10 items) | | | ***$452,800*** |
| Industrial Internship Program | | | |
| Aerial Biopharma LLC | Butts, Stephen | Industrial Intern Support - Deepika Poranki | $3,000 |
| G1 Therapeutics | Chant, John | Industrial Intern Support - Manish Agrawal | $3,000 |
| Galaxy Diagnostics, Inc. | Elam, Amanda B. | Industrial Intern Support - Eric Fish | $3,000 |
| Heat Biologics, Inc. | Wolf, Jeffrey | Industrial Intern Support - Michael Blanks | $3,000 |
| KeraFAST, Inc. | Cary, Zachary D. | Industrial Intern Support - Jessica Cotton | $3,000 |
| NC Biosciences Organization | Taylor, Samuel M. | Industrial Intern Support - Shannon Jones | $3,000 |
| NovaTarg, Inc. | Batchelor, Kenneth W. | Industrial Intern Support - Rachel Song | $3,000 |
| Total Industrial Internship Program (7 items) | | | ***$21,000*** |
| Multidisciplinary Research Grant | | | |
| Duke University | You, Lingchong | Modeling, Microfluidics and Quantitative Single Cell Signaling Dynamics | $250,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| East Carolina University | Lu, Qun | Cell-Cell Junction Protein as Biomarker for Prostate Cancer (Resubmission) | $250,000 |
| North Carolina State University | Carbonell, Ruben G. | Disposable, High-Throughput, High-Capacity Antibody Capture Membrane with In-Line Sensors | $250,000 |
| North Carolina State University | Ashwell, Melissa S. | Genetic Variation of Plasma Disposition Kinetics and Liver Gene Expression in the Pig and their Implications on Animal Welfare and Drug Efficacy (Resubmission) | $249,979 |
| UNC - Wilmington | Bourdelais, Andrea J. | Development of Ladder Frame Polyethers as Drug Escortins | $249,404 |
| Total Multidisciplinary Research Grant (5 items) | | | ***$1,249,383*** |
| Presidential Initiative Award | | | |
| Bent Creek Institute, Inc. | Cumberford, Greg W. | Targeted Services to Promote Agricultural Biotechnology-Related Economic Development Efforts in NC's Western Region. | $50,000 |
| North Carolina's Northeast Financing Alliance, Inc. | Rogerson, Vann R. | Marketing Development - Pilot Extraction Facility in Bertie County, NC | $50,000 |
| Total Presidential Initiative Award (2 items) | | | ***$100,000*** |
| Regional Development Grant | | | |
| Pitt County Development Commission | Andrews, Kelly L. | Eastern Region Bio Competitive Positioning Analysis | $42,000 |
| Research Triangle Foundation of North Carolina | Rooks, Liz | Medworks Joint Project | $65,000 |
| Wake Forest University Health Sciences | Mizel, Steven B. | Development of the North Carolina Center for Vaccine Innovation | $53,662 |
| Total Regional Development Grant (3 items) | | | ***$160,662*** |
| Strategic Growth Loan | | | |
| Arbovax, Inc. | Thomas, Malcolm | Testing of a Tetravalent Dengue Vaccine in a Non-human Primate Model | $250,000 |
| Heat Biologics, Inc. | Wolf, Jeffrey | Heat Biologics, Inc. | $250,000 |
| Total Strategic Growth Loan (2 items) | | | ***$500,000*** |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Small Business Research Loan | | | |
| Applied Catheter Technologies, Inc. | Wilson, Jon S. | Proposal for Optimal, Novel Synthesis of Halofuginone | $211,003 |
| CivaTech Oncology Incorporated | Hoedl, Seth A. | CivaSheet Bio-Compatibility Studies | $249,048 |
| G1 Therapeutics | Strum, Jay | G-Zero Therapeutics Small Business Loan (SBL) for NCBC | $250,000 |
| Trana Discovery, Inc. | Peterson, Steven E. | Proof of MOA - Projects for HIV and Staph Aureus tRNA Inhibitors | $35,000 |
| Zoion Pharma Inc. | Mossinghoff, Gregory J. | Zoion Pharma Inc. | $50,000 |
| Total Small Business Research Loan (5 items) | | | ***$795,051*** |
| Technology Enhancement Grant | | | |
| Duke University | Berger, Henry | Commercial Scale Fabrication of POEGMA-Coated Slides and Development of POEGMA-Coated Microplates | $50,000 |
| North Carolina Central University | Hoffler, Undi | Method for Sorting Pure Pancreatic Beta Cells from Dispersed Human Islets Using a Novel Transient Fluorescent Pre-pro-insulin Reporter | $50,000 |
| Total Technology Enhancement Grant (2 items) | | | ***$100,000*** |
| Undergraduate Biotechnology Research Fellowship | | | |
| Appalachian State University | Hester, Brooke C. | Optical studies of Organic Anion Transporters in Hydrosomes (Tyler Foley) | $5,000 |
| Davidson College | Sarafova, Sophia D. | Duke-Davidson Immunology Program (Gregory Swan) | $5,000 |
| Meredith College | Edwards, Cynthia | Bioassay of a Natural Insect Repellent, "Adios Outdoor Spray" (Jacqueline E. Bailey) | $4,450 |
| North Carolina State University | Day, Judy B. | Cell-Free Ultrahigh-Throughput Screens for the Directed Evolution of Glycosyltransferases (Hemant Desai) | $5,000 |
| North Carolina State University | Day, Judy B. | Development of Biotechnology Tools to Assess Reproductive Health of Blue Crab Populations (Kevin Kearney) | $5,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| North Carolina State University | Day, Judy B. | Recombinant Expression of a Thermostable Lipase from Metallosphaera sedula for Algae Biofuel Production (Rachel Turner) | $5,000 |
| UNC - Charlotte | Brown, Banita W. | Recovery of Viable Zone-specific Hepatocytes from Cardiac Death Donor Livers (Joshua Wheaton) | $5,000 |
| Total Undergraduate Biotechnology Research Fellowship (7 items) | | | ***$34,450*** |
| Total 2012 (127 items) | | | **$8,648,062** |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| 2011 | | | |
| Biotechnology Event Sponsorship | | | |
| Appalachian State University | Howson, Charna K. | The North Carolina Society of Research Administrators Conference | $3,000 |
| Asheville-Buncombe Technical Community College | Knott, Paul | Science in the Mountains 2011 | $3,000 |
| Association of Clinical Research Professionals | Mancour, Laurin C. | Emerging Trends in Clinical Research | $2,500 |
| Contemporary Science Center | Zuiker, Anton J. | ScienceOnline2011 | $2,000 |
| Duke University | Setton, Lori A. | North Carolina Tissue Engineering & Regenerative Medicine Society (NCTERMS) Annual Conference | $2,500 |
| East Carolina University | McMillen, Brian A. | 12th Annual Neuroscience Symposium | $1,351 |
| Elon University | Niedziela, Linda M. | NC Academy of Science 108th Annual Meeting | $2,000 |
| Forsyth Technical Community College | Read, Russel H. | SciTech Lecture Series Presentation by Dr. Mark Wainberg on "The Benefits of 25 Years of HIV Research on Laboratory Technology and Human Health" | $2,500 |
| Greater Winston-Salem Chamber of Commerce | Howell, Andrea | Winston-Salem Chamber Technology Council. Celebrating 20 Years of Vision, Innovation, and Growth | $2,500 |
| Meredith College | Cuffney, Francie S. | State of North Carolina Undergraduate Research and Creativity Symposium | $2,500 |
| North Carolina Association for Biomedical Research | Wilkison, Suzanne W. | Biosafety and Biocontainment: A One-Day Workshop Addressing Effective IBCs and Biological Risk Assessment | $3,000 |
| North Carolina Association for Biomedical Research | Wilkison, Suzanne W. | Update to the Guide for the Care and Use of Laboratory Animals: The National Academy of Sciences' 8th Edition | $3,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Faulconer, Laura S. | NanoBio CEO Roundtable | $600 |
| North Carolina Center of Innovation for Nanobiotechnology | Faulconer, Laura S. | Nanomedicine: Critical Commercialization Issues | $2,000 |
| North Carolina State University | Day, Judy B. | NC State University Summer Undergraduate Research Symposium | $900 |
| North Carolina State University | Chisnell, John R. | 2010 Molecular Biotechnology Research Symposium | $1,700 |
| North Carolina State University | Day, Judy B. | North Carolina State University Undergraduate Research Symposium: April 12, 2011 | $1,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| North Carolina State University | DiMeo, Andrew J. | 5th Annual Biomedical Engineering Symposium | $1,685 |
| North Carolina State University Vernon G. James Research & Extension Center | Gurganus, Kent Rodgers | Agbiotech Opportunities for Farmers and Growers: Planting Ideas for Now and the Future in Northeast NC | $3,000 |
| UNC - Chapel Hill | Rhodes, Julie | North Carolina Science Festival | $2,500 |
| UNC - Chapel Hill | Bankaitis, Vytas A. | Cell Adhesion and Stress Fibers Symposium | $1,649 |
| UNC - Chapel Hill | Strahl, Brian D. | 5th Annual Atlantic Coast Chromatin Conference Meeting title: "Chromatin Structure and Function" | $2,000 |
| UNC - Chapel Hill | Ashby, Valerie S. | North Carolina Alliance to Create Opportunity Through Education (NC OPT-ED) Ninth Annual Alliance Day Conference | $1,500 |
| UNC - Chapel Hill | Cox, Adrienne D. | What Goes Around Comes Around: Biological Oscillators in Human Health and Disease | $2,500 |
| UNC - Chapel Hill | Maeda, Nobuyo | Integrative Vascular Biology (IVB) & UNC McAllister Heart Institute (MHI) Annual Symposium | $2,500 |
| UNC - Chapel Hill | Meyer, Thomas J. | Solar Fuels: Catalysis and Photoconversion and Putting Solar Energy in its Place | $2,500 |
| UNC - Chapel Hill | Hall, Joshua | North Carolina DNA Day | $3,000 |
| UNC - Chapel Hill | Earp, H. Shelton | The 35th Annual UNC Lineberger Comprehensive Cancer Center Symposium "Cell Metabolism and Cancer" | $3,000 |
| UNC - Charlotte | Faggart, Clare C. | Ninth Annual Charlotte Biotechnology Conference | $3,000 |
| UNC - Charlotte | Faggart, Clare C. | 2011 10th Annual Five Ventures Business Innovation Competition | $3,000 |
| UNC - Charlotte | Swartz, Caroline | Charlotte Biotechnology Consultancy Challenge | $500 |
| UNC - General Administration | Thornton, Courtney H. | University-Industry Demonstration Partnership Fall 2010 Meeting | $2,850 |
| UNC - Greensboro | Welsh, Dianne | Biotech Startups: What You Need To Know | $1,500 |
| UNC - Pembroke | Holmes, Leonard D. | Second Annual Farm Bureau of Robeson County Bio-Ag Symposium | $1,500 |
| Wake Forest University | Cary, Zachary D. | Wake Forest Schools of Business Biotechnology Conference and Case Competition | $2,500 |
| Watauga County Office of Economic Development | Furman, Joe | High Country Natural Products Conference | $961 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Total Biotechnology Event Sponsorship (36 items) | | | ***$77,696*** |
| Biotechnology Meeting Grant | | | |
| American Foundation for Aging Research | O'Hara, Ann M. | 3rd Biennial AFAR-GlaxoSmithKline Symposium on the Biology of Aging | $7,730 |
| North Carolina State University | Cardinal, Andrea Josefina | 13th Biennial Molecular and Cellular Biology of the Soybean Conference | $3,000 |
| North Carolina State University | Muddiman, David Charles | 2011 Annual Meeting of the United State Human Proteome Organization: "Proteomics: New Developments and Grand Challenges" | $10,000 |
| Society for In Vitro Biology | Ellis, Marietta Wheaton | 2011 In Vitro Biology Meeting | $8,525 |
| UNC - Chapel Hill | Thakker, Dhiren R. | The 8th Globalization of Pharmaceutics Education Network Meeting (GPEN 2010) | $10,000 |
| Western Carolina University | Butcher, David J. | Federation of Analytical Chemistry and Spectroscopy Societies (FACSS) 2010 | $5,000 |
| Total Biotechnology Meeting Grant (6 items) | | | ***$44,255*** |
| Biotechnology Research Grant | | | |
| Carolinas Medical Center | Wang, Mingxing | Amphiphilic Polymer Modified PMO for Treating Duchenne Muscular Dystrophy by Exon-Skipping | $73,500 |
| East Carolina University | Thompson, Beth E. | Combinatorial Control of Gene Expression by the MADS-box Transcription Factor BEARDED-EAR in Maize Floral Development | $73,790 |
| North Carolina Agricultural & Technical State University | Sang, Shengmin | Pterostilbene Aspirinate as a Novel Chemopreventive Agent for Colon Cancer | $75,000 |
| North Carolina Central University | Sexton, Jonathan Z. | Assay Development for Stimulated Insulin Release and Trafficking | $75,000 |
| UNC - Greensboro | Hall, Adam R. | Molecular Footprinting with Solid-state Nanopores for Preventative Disease Diagnostics | $75,000 |
| UNC - Greensboro | Oberlies, Nicholas H. | Endophytic Fungi, Bioactive Natural Products, and the NC Botanical Economy | $75,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| UNC - Wilmington | Wright, Jeffrey L.C. | Chemical and Biological Studies on a New Antiviral Compound from a Cultured Marine Dinoflagellate | $74,961 |
| Wake Forest University Health Sciences | Wagner, William D. | Bioresorbable Elastomeric Device for Cleft Palate Closure | $73,074 |
| Total Biotechnology Research Grant (8 items) | | | ***$595,325*** |
| Collaborative Funding Grant | | | |
| Duke University Medical Center | Chen, Jun | Biological Composite Joint Resurfacing for the Treatment of Osteoarthritis | $100,000 |
| North Carolina State University | Gould, Fred | Improving Transgenesis Methods for Economically Important Lepidoptera | $100,000 |
| UNC - Chapel Hill | Cho, M. J. | New Chemical Entities for Targeted Release of Generic Chemotherapies | $100,000 |
| UNC - Greensboro | Oberlies, Nicholas H. | Antiparasitic Compounds from Filamentous Fungi | $100,000 |
| Total Collaborative Funding Grant (4 items) | | | ***$400,000*** |
| Company Inception Loan | | | |
| CertiRx Corporation | Mercolino, Thomas J | CertiRx Corporation Inception | $30,000 |
| Qualiber, Inc | Goyal, Anil K. | Corporate and Business Development | $30,000 |
| Zoion Pharma Inc. | Mossinghoff, Gregory J. | Zoion Pharma Inc. inception funding | $30,000 |
| Total Company Inception Loan (3 items) | | | ***$90,000*** |
| Center of Innovation | | | |
| ibiliti | Clark, Cindy L. | Advanced Medical Technologies Center Phase II COI- Renewal Funding | $670,000 |
| North Carolina Center of Innovation for Nanobiotechnology | Adams, Gregory Brooks | Phase II: Implementation Stage Funding- Bridge Funds | $150,000 |
| North Carolina Drug Discovery Center of Innovation | Ehrlich, Paula J. | Drug Discovery Center of Innovation Phase 2 Grant Renewal Funding | $900,000 |
| North Carolina's Eastern Region Development Commission | Chaffee, John D. | Marine Biotechnology Center of Innovation (MBCOI) Phase II - Initial Funding | $250,000 |
| Total Center of Innovation (4 items) | | | ***$1,970,000*** |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Economic Development Award | | | |
| First Flight Venture Center | Schwab, Andrew | Infrastructure Improvements to Convert Office Spaces to Wet Labs | $50,000 |
| Total Economic Development Award (1 item) | | | ***$50,000*** |
| Education Enhancement Grant | | | |
| Appalachian State University | Venable, Mark E. | Cellular and Molecular Biology 2010 | $85,400 |
| Avery County Public Schools | Grice, John A. | Growing Biotechnology One Student at a Time | $26,003 |
| Campbell University | Guzman, Karen | Enhancement of an Undergraduate Program by Improving Student Understanding of the Relationship Between Biotechnology and the Biology of the Cell | $33,107 |
| Contemporary Science Center | Blizzard, Pamela | Development and First-Year lmplementation of a Nanobiotechnology Camp for Students in Secondary and Post-Secondary School | $50,550 |
| East Carolina University | Pan, Xiaoping | Incorporation of Capillary Electrophoresis into ECU's Biotechnology Education Curriculum | $71,621 |
| Lenoir-Rhyne University | Schaefer, Scott C. | Recombinant Biotechnology Intensive Course | $40,141 |
| Mars Hill College | Loomis, Kari D. | Reviving Biotechnology at Mars Hill College | $36,801 |
| Olympic High School | Bozeman, Angela P. | Feeding the Biotech Pipeline | $29,688 |
| Pitt Community College | Dittmar, Ulla S. | PCC Cell Culture Enhancement: Cellometer Auto T4 | $5,970 |
| Polk County High School | Allsbrook, Jennifer C. | PCHS Magnolia Detectives Project | $14,000 |
| SciWorks | Sanford, Beverly S. | Biotechnology and BrainWorks | $20,000 |
| Wake Technical Community College | Morgan, Michael K. | Implementation of GC-FAME Instrumentation at the NC BioNetwork Capstone Center | $72,533 |
| Total Education Enhancement Grant (12 items) | | | ***$485,814*** |
| Education & Training Workshop | | | |
| Campbell University | Bloom, Emily M. | What Do YOU Think? Using Inquiry to Teach Middle School Science - July 11-14, 2011 | $10,587 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Duke University Marine Laboratory | Dillon, Judith | Special Topics on Marine Biotechnology: Molecular Tools for Species Identification | $18,820 |
| North Carolina State University Biomanufacturing Training and Education Center | Stroud, Lori L. | Biotech Bag of Teaching Tricks for Middle School Teachers - June 20-23, 2011 | $11,504 |
| UNC - Asheville | Ward, Jennifer Rhode | Introductory Workshop for High School Teachers: Biotechnology & Human Health - June 20-24, 2011 | $22,632 |
| UNC - Asheville | Ward, Jennifer Rhode | Special Topics Workshop for Secondary and Tertiary Teachers 2011: Biotechnology - Gene Expression, Stem Cells, and Human Health - June 20, 24, 2011 | $19,466 |
| UNC - Charlotte | Warner, Jennifer M. | Introductory Biotechnology Workshop for High School Teachers - July 11-15, 2011 | $26,963 |
| UNC - Charlotte | Warner, Jennifer M. | Microbial Magic: A Workshop for Middle School Teachers Connecting Microbiology, Genetics, and Biotechnology - July 25-28, 2011 | $22,055 |
| UNC - Wilmington | Shafer, Karen S.D. | UNCW Introductory Biotechnology Workshop for High School Teachers - June 20-24, 2011 | $22,863 |
| Total Education & Training Workshop (8 items) | | | ***$154,890*** |
| Grantsmanship Training Grant | | | |
| Asheville-Buncombe Technical Community College | Mikula, Nancy | Grant Skills for the North Carolina Life Science Economy | $5,000 |
| Duke University | Andersson, Judith | "Writing from the Reader's Perspective" Workshop Series by George Gopen | $3,000 |
| Total Grantsmanship Training Grant (2 items) | | | ***$8,000*** |
| Institutional Development Grant | | | |
| Duke University | Johnson, Sam A. | Long-term Fluorescence Time-lapse Imaging System for the Light Microscopy Core Facility at Duke University | $115,880 |
| Duke University Medical Center | Ginsburg, Geoffrey S. | Advancing Infectious Diseases Biomarkers: Migration of Gene Expression Signatures to Next-generation Point-of-care Diagnostic Devices | $83,370 |
| Duke University Medical Center | Dewhirst, Mark W. | Fluorescence Molecular Tomography Shared Resource | $184,678 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| East Carolina University | Brown, Jared M. | Rodent Inhalation System to Assess Health Risks Associated with Nanoparticle Exposure | $143,308 |
| North Carolina State University | Scott, Maxwell J. | Establishment of an Insect Transgenesis Facility | $141,757 |
| North Carolina State University Mountain Horticultural Crops Research & Extension Center | Panthee, Dilip R. | Development of Molecular Genetics Research Facility for the Advancement of Agriculture and Natural Sciences Research in Western North Carolina | $68,508 |
| UNC - Chapel Hill | Allbritton, Nancy L. | Advanced Micromachining Capabilities for Creating State-of-the-Art Biomedical Microdevices | $195,500 |
| UNC - Chapel Hill | Carson, Johnny L. | Acquisition of Digital Imaging Resources for High Resolution Transmission Electron Microscopy in a Core Microscopy Facility of the UNC School of Medicine | $57,815 |
| UNC - Chapel Hill | Jones, Alan M. | Acquisition of a CCD Camera System for High Through-put Genetic Screens Based on Emitted Light | $115,840 |
| UNC - Chapel Hill | Tripathy, Ashutosh | UNC Acquisition of a BMG LABTECH PHERAstar FS Microplate Reader | $140,496 |
| UNC - Greensboro | Henrich, Vincent C. | Real Time PCR and Cell Culture for the UNCG Molecular/Cell Biology Core Facility | $39,920 |
| UNC - Wilmington | Song, Bongkeun | Roche Applied Science (RAS) GS Junior System for High Throughput DNA Sequence Core Facility at the Center for Marine Science, University of North Carolina Wilmington | $91,700 |
| Total Institutional Development Grant (12 items) | | | ***$1,378,772*** |
| Industrial Fellowship Program | | | |
| Banner Pharmacaps, Inc. | Dyakonov, Tatyana A. | Industrial Fellowship Support - William Bush - Year 2 | $38,560 |
| CiVentiChem, LLC | Venepalli, Bhaskar | Industrial Fellowship Support - Joseph Kaloko - Year 1 | $47,000 |
| Ethicon, Inc. | Voiers, Tony | Industrial Fellowship Support - Benjamin Moody - Year 1 | $37,000 |
| GrassRoots Biotechnology, Inc. | Eisner, Douglas A | Industrial Fellowship Support - Patrick Vincent-Pope - Year 1 | $47,000 |
| Metabolon, Inc. | Lynch, Todd S. | Industrial Fellowship Support - Meredith Brown - Year 1 | $42,000 |
| Pioneer Surgical Orthobiologics | Hill, Ronald S. | Industrial Fellowship Support - Willson Kwok - Year 2 | $38,560 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Tandem Labs, Inc. | Grosshandler, Todd | Industrial Fellowship Support - Susan Deupree - Year 2 | $43,560 |
| Zen-Bio, Inc. | Pieraccini, Peter | Industrial Fellowship Support - Sarah Compton - Year 1 | $47,000 |
| Total Industrial Fellowship Program (8 items) | | | ***$340,680*** |
| Multidisciplinary Research Grant | | | |
| Carolinas Medical Center | McKillop, Iain H. | Development of a Bioceramic Scaffold for use in Hepatocellular Carcinoma Chemotherapy | $199,125 |
| North Carolina Central University | Chen, Xiaoxin Luke | Pig Model of Gastroesophageal Reflux Disease and Barrett's Esophagus | $250,000 |
| Wake Forest University | Guthold, Martin | Accelerated Discovery of Small Molecules by Preselection-coupled NanoSelection® Method | $250,000 |
| Wake Forest University Health Sciences | Claiborne, Al | Targeting Bacillithiol and Thiol-based Redox Homeostasis in Bacillus anthracis | $246,756 |
| Total Multidisciplinary Research Grant (4 items) | | | ***$945,881*** |
| SBIR Bridge Loan | | | |
| Agile Sciences Inc. | Garland, Eva R | Increasing the Efficiency of Membrane Filtration through the Incorporation of Novel Anti-Biofilm Small Molecules | $75,000 |
| Total SBIR Bridge Loan (1 item) | | | ***$75,000*** |
| Regional Development Grant | | | |
| First Flight Venture Center | Spratt, Joseph | Wet Lab Expansion Project | $25,000 |
| UNC - General Administration | Boney, Leslie | Profiling Expertise in the Piedmont Triad | $75,000 |
| Total Regional Development Grant (2 items) | | | ***$100,000*** |
| Strategic Growth Loan | | | |
| Neuronex, Inc. | Khayrallah, Moise A. | A Definitive Bioequivalence Study and Related Drug Manufacturing Activities for a New Product in the Treatment of Patients with Epilepsy | $250,000 |
| Total Strategic Growth Loan (1 item) | | | ***$250,000*** |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| Small Business Research Loan | | | |
| BioKier, Inc. | Nolan, Roger D. | Development of an Oral Therapeutic for the Treatment of Type 2 Diabetes | $250,000 |
| Brighthaven Ventures LLC d/b/a BHV Pharma | Wilkison, William O. | Remogliflozin Etabonate: Formulation Study | $250,000 |
| EntoGenetics Incorporated | Brigham, David L. | EntoGenetics: Genetically Engineered Super Fibers | $224,914 |
| Neuronex, Inc. | Ketteridge, Paul | Formulation Development and Manufacturing to Support a Phase I Clinical Trial for Epilepsy | $250,000 |
| Total Small Business Research Loan (4 items) | | | ***$974,914*** |
| Technology Enhancement Grant | | | |
| North Carolina State University | Whitehead, Rob | Novel Near-Infrared Dyes for Diagnostic Applications | $50,000 |
| North Carolina State University | Sexton, Kelly B | Validation of a Live Salmonella Vaccine in Poultry | $50,000 |
| UNC - Chapel Hill | Quay, Jackie | LCP: Biodegradable Calcium Phosphate Nanoparticle with Lipid Coating for Systemic siRNA Delivery | $49,842 |
| UNC - Chapel Hill | Nowak, Henry P. | Water Soluble Extended NeuroAmides (ENAs): Neurological Agents That Can Be Readily Administered to Patients | $50,000 |
| UNC - Charlotte | Fach, Brad | Dry Preservation of Vaccines Using Microwave Processing | $50,000 |
| Total Technology Enhancement Grant (5 items) | | | ***$249,842*** |
| Undergraduate Biotechnology Research Fellowship | | | |
| Appalachian State University | Mowa, Chishimba Nathan | John Schwabe: Profiling cervical collagen expression for predicting birth (Mentor: Nathan Mowa/Track 3) | $5,000 |
| Appalachian State University | Mowa, Chishimba Nathan | Bao-Tran Nguyen: Preventing Premature Births the Natural Way: A Feasibility Study Using Echinacea (Mentor: Nathan Mowa/Track 2) | $5,000 |
| Appalachian State University | Mowa, Chishimba Nathan | Colin Curtis: Characterization of Collagen in Solution and in Tissue Using Raman Spectroscopy (Mentor: Jennifer Burris/Track 3) | $5,000 |
| Davidson College | Sarafova, Sophia D. | Thomas Silvers: Duke-Davidson Immunology Partnership (Mentor: Shyam Unniraman/Track 3) | $5,000 |

| Organization Name | Primary Contact | Project Title | Original Award Amount |
|---|---|---|---|
| East Carolina University | Farwell, Mary A. | Jina Lee: Undergraduate Agricultural Biotechnology Fellowship for (Mentor: Boahong Zhang/Track 4) | $5,500 |
| East Carolina University | Farwell, Mary A. | Omalola Okanlowon; Biotechnology Undergraduate Research Fellowship for (Mentor: Xioping Pan/Track 3) | $5,000 |
| North Carolina State University | Day, Judy B. | Victoria Crisci: Identification of cell-type specific peptide ligands for human pancreatic B-cells (Mentor: Paul Hamilton/Track 1) | $5,000 |
| North Carolina State University | Day, Judy B. | Mary Patricia Bulfin: Identification of the gene responsible for the chicken L alloantigen by whole genome association mapping and assessment of potential implications on poultry immunological response (Mentor: Christopher Ashwell/Track 4) | $5,000 |
| UNC - Asheville | Meigs, Thomas E. | Douglas N. Brawley: Structural Characterization of G{alpha}12 Interaction with the Non-receptor Activator Ric-8. Student researcher (Faculty mentor: Thomas E. Meigs/Track 3) | $5,000 |
| UNC - Charlotte | Krueger, Joanna K. | Jasmine King: Protein Stability Studies for Bio-therapeutic Applications (Mentor: Joanna Krueger/Track 3) | $5,000 |
| UNC - Greensboro | Crowe, Mary | Verrico Boyd: Real-time PCR Characterization of Microbial Communities on Mount Desert IslandMentor: Parke Rublee/Track 3) | $5,000 |
| UNC - Greensboro | Crowe, Mary | Robert Amend: Refinement of a cell based assay for screening novel insecticides (Mentor: Vincent Henrich/Track 4) | $5,500 |
| UNC - Pembroke | Bahr, Ben A. | Rebecca Howell: 2011 Fellowship: Assessing Lysosomal Modulators in Models of Frontotemporal Dementia (Mentor: Deborah Lundin/Track 1) | $5,000 |
| Western Carolina University | Van Dyke, Michael W. | Catherine Denning: Structural Studies of the Stress-response Translation Regulator Stm1p (Mentor:Michael Van Dyke/Track 3) | $5,000 |
| Total Undergraduate Biotechnology Research Fellowship (14 items) | | | ***$71,000*** |
| Total 2011 (135 items) | | | **$8,262,069** |

# STATE OF NORTH CAROLINA

## NORTH CAROLINA BIOTECHNOLOGY CENTER

## FINANCIAL RELATED AUDIT

**OCTOBER 2013**

## OFFICE OF THE STATE AUDITOR

**BETH A. WOOD, CPA**

**STATE AUDITOR**

# NORTH CAROLINA BIOTECHNOLOGY CENTER

# FINANCIAL RELATED AUDIT

**OCTOBER 2013**

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STATE OF NORTH CAROLINA
Office of the State Auditor

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# AUDITOR'S TRANSMITTAL

October 31, 2013

The Honorable Pat McCrory, Governor
The General Assembly of North Carolina
Board of Directors, North Carolina Biotechnology Center
E. Norris Tolson, President and Chief Executive Officer

This report presents the results of our financial related audit at the North Carolina Biotechnology Center. Our work was performed by authority of Article 5A of Chapter 147 of the *North Carolina General Statutes* and was conducted in accordance with the performance audit standards contained in *Government Auditing Standards*, issued by the Comptroller General of the United States.

The results of our audit disclosed a deficiency in internal control and/or instance of noncompliance or other matters that is considered reportable under *Government Auditing Standards*. This item is described in the *Audit Findings and Responses* section of this report.

*North Carolina General Statutes* require the State Auditor to make audit reports available to the public. Copies of audit reports issued by the Office of the State Auditor may be obtained through one of the ways listed in the back of this report.

Beth A. Wood, CPA
State Auditor

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# BACKGROUND

As authorized by Article 5A of Chapter 147 of the *North Carolina General Statutes*, we have conducted a financial related audit at the North Carolina Biotechnology Center. There were no special circumstances that caused us to conduct the audit, but rather it was performed as part of our effort to periodically examine and report on the financial practices of not-for-profit entities that receive State appropriations.

The North Carolina Biotechnology Center (Center) was founded in 1984 as a private, non-profit organization. Its mission is to provide long-term economic and societal benefits to North Carolina through support of biotechnology research, business, education, and strategic policy. Biotechnology, according to Webster's Dictionary, is the manipulation (as through genetic engineering) of living organisms or their components to produce useful, usually commercial products. Biotechnology is used in areas such as making food more efficiently by increasing the yield per acre, making medicines and vaccines, and finding alternatives to fossil-based fuels to reduce pollution.

The General Assembly appropriated $17,551,710 in State funds to the Center for fiscal year ended June 30, 2012. Approximately 92% of the Center's financing came from State appropriations during the year, with 8% coming from private gifts and grants or receipts for services. With the addition of other revenue sources, total expenditures for the Center totaled $19,710,227. The expenditures were spent in the following categories: $6,842,804 for grant expenditures, $5,557,712 for program management expenditures, $2,930,181 for general and administrative expenditures, and $4,379,530 for other program and initiative expenditures. In addition, $1,386,867 was paid out as loans to biotechnology companies.

# AUDIT SCOPE AND OBJECTIVES

The general objective of this financial related audit was to identify improvements needed in internal control over selected fiscal matters. Management is responsible for establishing and maintaining effective internal control. Internal control is a process designed to provide reasonable assurance that relevant objectives are achieved. Errors or fraud may nevertheless occur and not be detected because of the inherent limitations of internal control. Also, projections of any evaluation of internal control to future periods are subject to the risk that conditions may change or that compliance with policies and procedures may deteriorate. Our audit does not provide a basis for rendering an opinion on internal control, and consequently, we have not issued such an opinion.

Our audit scope covered the period July 1, 2011, through June 30, 2012. During our audit, we considered internal control related to the following accounts and control objectives:

*Notes Receivable* – The North Carolina Biotechnology Center (Center) loans state appropriations to biotechnology companies to facilitate company inception, research, and growth. On June 30, 2012, the Center reported a total of $8,623,893 notes receivable which covers multiple years of loans. Of this total, the Center paid out $1,386,867 of State funds on loan contracts during the audit period. Our objective was to determine if the Center had an adequate process in place to award and monitor the use of the loans. We examined internal control designed to ensure that the Center makes loans to appropriate parties with reasonable chance of repayment, that loans had been properly authorized, that signed contracts were obtained, that loans were monitored to prevent misuse of State funds, and that contract requirements were followed by the Center's subgrantees.

*Allowance for Uncollectable Accrued Interest, Loan & Notes* – This allowance account is the contra valuation account used to report the Center's expectation of loans and interest to be uncollectable. At June 30, 2012, the Center reported $5,621,643 as its estimated uncollectable loan balance. This balance represents 61% of notes receivable. Our objective was to determine if the estimate was reasonable. We examined the Center's methodology to estimate the uncollectable loans and interest and compared the estimate to historical data of loan collections of the Center.

*Grant Expenditures* – The Center awards grants to organizations for collaboration, new ideas, education, research, and other activities that will make a technology licensable. During the audit period, the Center paid out $6,842,804 in State appropriations to various types of grants. Our audit focused on two significant types of grants: Science and Technology grants and Centers of Innovation grants. Science and Technology grants fund biotechnology research and product invention. The Center spent $3,202,136 (47%) on Science and Technology grants in the fiscal year ended June 30, 2012. Centers of Innovation grants fund expenditures related to accelerating growth in selected biotechnology industries and the commercialization of research in those fields. The Center spent $2,043,046 (30%) on Centers of Innovation grants in the fiscal year ended June 30, 2012. Our objective was to determine if the Center had an adequate process in

place to distribute and/or monitor the grants. We examined internal control designed to ensure that the Center makes grants to appropriate parties, that grants originating in our period had proper contracts, that grants were monitored to prevent misuse of State funds, that contract requirements were followed by the Center's subgrantees, and that the Center complies with State laws and regulations.

# METHODOLOGY

To accomplish our audit objective, we gained an understanding of internal control over matters described in the *Audit Scope and Objectives* section of this report and evaluated the design of the internal control. We then performed further audit procedures consisting of tests of control effectiveness and/or substantive procedures that provide evidence about our audit objectives. Specifically, we interviewed personnel, observed operations, reviewed policies, analyzed accounting records, and examined documentation supporting recorded transactions and balances, as considered necessary in the circumstances. Whenever sampling was used, we applied a nonstatistical approach but chose sample sizes comparable to those that would have been determined statistically. As a result, we were able to project our results to the population but not quantify the sampling risk.

As a basis for evaluating internal control, we applied the internal control guidance contained in professional auditing standards. As discussed in the standards, internal control consists of five interrelated components: (1) control environment, (2) risk assessment, (3) control activities, (4) information and communication, and (5) monitoring.

We conducted this audit in accordance with generally accepted government auditing standards applicable to performance audits. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# RESULTS AND CONCLUSIONS

The results of our audit disclosed a deficiency in internal control and/or instance of noncompliance or other matters that is considered reportable under generally accepted government auditing standards. This deficiency was related to the *Grant Expenditures* account/objective. This item is described in the *Audit Findings and Responses* section of this report. Management's response is presented after the audit finding. We did not audit the response, and accordingly, we express no opinion on it.

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Government Auditing Standards require that we add explanatory comments to the report whenever an audit finding response is inconsistent or conflicts with the finding or recommendation. In accordance with this requirement and to ensure that the nature and seriousness of the findings are not minimized or misrepresented, we have provided comments to the Center's response.

ADDITIONAL DOCUMENTATION NEEDED FOR GRANT REIMBURSEMENT

The North Carolina Biotechnology Center (Center) reimbursed subrecipients for grant expenditures without always obtaining adequate documentation. Further, the Center's program review results are not communicated to the financial staff responsible for grant reimbursements. This lack of consistency could result in reimbursements made in error.

Documentation

During the audit period, the Center reimbursed subrecipients $5,245,182 for Science and Technology and Centers of Innovation grants. Our test of a sample of 21 payments totaling $662,233 out of 110 transactions revealed that four Science and Technology grant payments were made without adequate support to determine that the subrecipient had actually incurred the expenditures reported. These four reimbursement requests, totaling $277,563, and representing 42% of the amount tested, did not include the support for reimbursement, such as copies of invoices, payroll registers, etc., as required of other similar subrecipients.

Grant Monitoring

The lack of formal communication between the financial staff and program experts may result in payments being made to subrecipients that should have otherwise been stopped or reduced. The Center's financial staff makes payments to reimburse subrecipients for qualified expenditures based on the individual terms of each grant. The Center's technical program experts perform desk reviews and on-site visits of subrecipients to determine that the grant objectives are achieved. However, we noted that these desk reviews and on-site visits, which document the subrecipients' progress toward meeting the agreed upon goals of the grant, are not communicated to the financial staff who process the payments. While no issues were noted in our sample, if problems were to be identified during the monitoring visits or desk reviews, the lack of formal communication may result in payments being made that should have otherwise been stopped or reduced.

*Recommendation:* The North Carolina Biotechnology Center should require adequate support with all reimbursement requests to ensure that they are valid and support the program objectives. In addition, the Center should communicate the grantees' progress to the financial staff to ensure that cost reimbursements are consistent with the accomplishment of the grant objective.

*Auditee Response*: We appreciate the State Auditor's professional and comprehensive review of our grant and loan programs. We pride ourselves in being good stewards of the State's dollars by carefully evaluating grant proposals and being conservative in our lending and

valuation, as noted here in this report. We agree with the audit finding that good documentation and communication are critical to ensuring that limited resources are spent as intended with the proposed outcomes. Our response to the finding is below:

**Documentation**

The four reimbursement requests, that gave rise to the finding, were all made to large institutions. The Biotech Center's grant agreement requires all subrecipients to keep receipts, vendor invoices, payroll registers and other documents that support their grants. We require subrecipients to make such documentation available to Biotech Center staff upon request. Each subrecipient signs a contract accepting that responsibility.

Larger institutions generally do not submit this documentation; however, they maintain it on file in their systems and send us a basic invoice. Others, often smaller institutions, choose to submit the documentation with their invoices.

Additionally, these larger institutions receive both Federal and State grant funds for which a Single Audit is required. The Single Audit is also called an A-133 audit, which is performed annually by an independent certified public accountant (CPA) and is a rigorous, organization-wide audit designed to provide assurance as to the entity's internal controls, and management and use of both Federal and State funds. If a subrecipient institution falls under the A-133 requirement, the Biotech Center obtains, reviews, and relies upon the Single Audit report as evidence that the institution has adequate controls in place over their grant administration process.

We acknowledge the responsibility to ensure that grant funds are spent according to the parameters of the grant award. Based on the Auditor's recommendations, we will randomly request and review, on a quarterly basis, test samples of documentation to support invoices from subrecipients that do not already provide such documentation.

Responsibility for requesting test samples as indicated above resides with the financial staff of the Biotech Center and we will begin this process in the third quarter of fiscal year 2014.

**Grant Monitoring**

While the technical program experts and the financial staff do communicate regularly regarding progress on assigned projects, we acknowledge that documentation supporting that communication could be enhanced. Our current communication methods will be enhanced to provide additional documentation in the financial files to improve accountability.

Progress reports - Subrecipients file periodic progress reports as required by the terms of their grant agreement put in place upon award. Program experts review these reports ("desk review") to ensure they are consistent with the original approved grant proposal. The findings of the desk review are currently communicated informally to financial staff if there are interim steps, with the final communication being a simple signature. We will enhance this process by instituting a new formal notification and check-off document from program experts to

financial staff that captures any interim steps (such as requests for additional information) and also provides more specificity for whether payments should be suspended or cancelled. The responsibility for communicating the results of these reviews will reside with the Biotech Center program experts and will begin during the 3rd quarter of fiscal year 2014.

Final reports – Final payments are not disbursed to grantees until final project reports are filed by the subrecipient, reviewed and approved by Biotech Center program experts, and communicated to financial staff. These reports contain a summary of the outcomes of the project as well as an accounting of the actual expenditures, and are reviewed for compliance with the Aims and Budget from the original approved grant proposal.

Site visits conducted by Biotech Center program experts – Biotech Center program experts conduct site visits with the principal research experts of the subrecipient for select grants throughout the year. These visits address the progress of subrecipient activities toward meeting the approved grant objectives. While these visits are not intended to review the subrecipient's financial administration of the grant, the Biotech Center will prepare a list of appropriate project budget-related questions for the program experts to pose to the subrecipients during the visit. Site visit reports are currently prepared but will be enhanced to include the results of the questionnaire as well as language which authorizes the continuation of payments by Biotech Center financial staff. The resulting site visit reports will then be provided to Biotech Center financial staff for review and follow-up if needed. The development of the budget related questionnaire is assigned to Biotech Center financial staff working with program staff for implementation in the 3rd quarter of fiscal year 2014.

Site visits conducted by Biotech Center financial staff – As a result of the auditor's finding, the Biotech Center will also require financial staff to perform a limited number of site visits each year to a subrecipient's grant administration office (e.g. a university's Office of Sponsored Research) for the purpose of document inspection and verification of expenses. A report of the visit will be prepared and placed in the grant file to substantiate the enhanced monitoring procedure. Responsibility for these site visits will reside with the Biotech Center's financial staff and may begin during the 3rd quarter of fiscal year 2014.

Quarterly Meetings – Finally, beginning in the third quarter of fiscal year 2014, technical program experts and financial staff of the Biotech Center will meet formally on a quarterly basis to discuss the status of active grants and address concerns, if any.

*Auditor's Comment*: In its response for the Documentation section of the finding, the auditee stated that receipts, vendor invoices, payroll registers and other documents that support the subrecipients' expenditures of the large institutions grants were not required to be submitted with the subrecipients' request for reimbursement but were to be made available to Biotech Center staff upon request. During our audit period the Biotech Center did not request additional documentation from the larger institutions. If these requests had been made and the documentation reviewed, this finding would not have been necessary. In its response, the auditee stated that site visits will now be conducted to review a sample of the documents. If sufficient monitoring is performed, this action will address our issue.

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Bill Holmes
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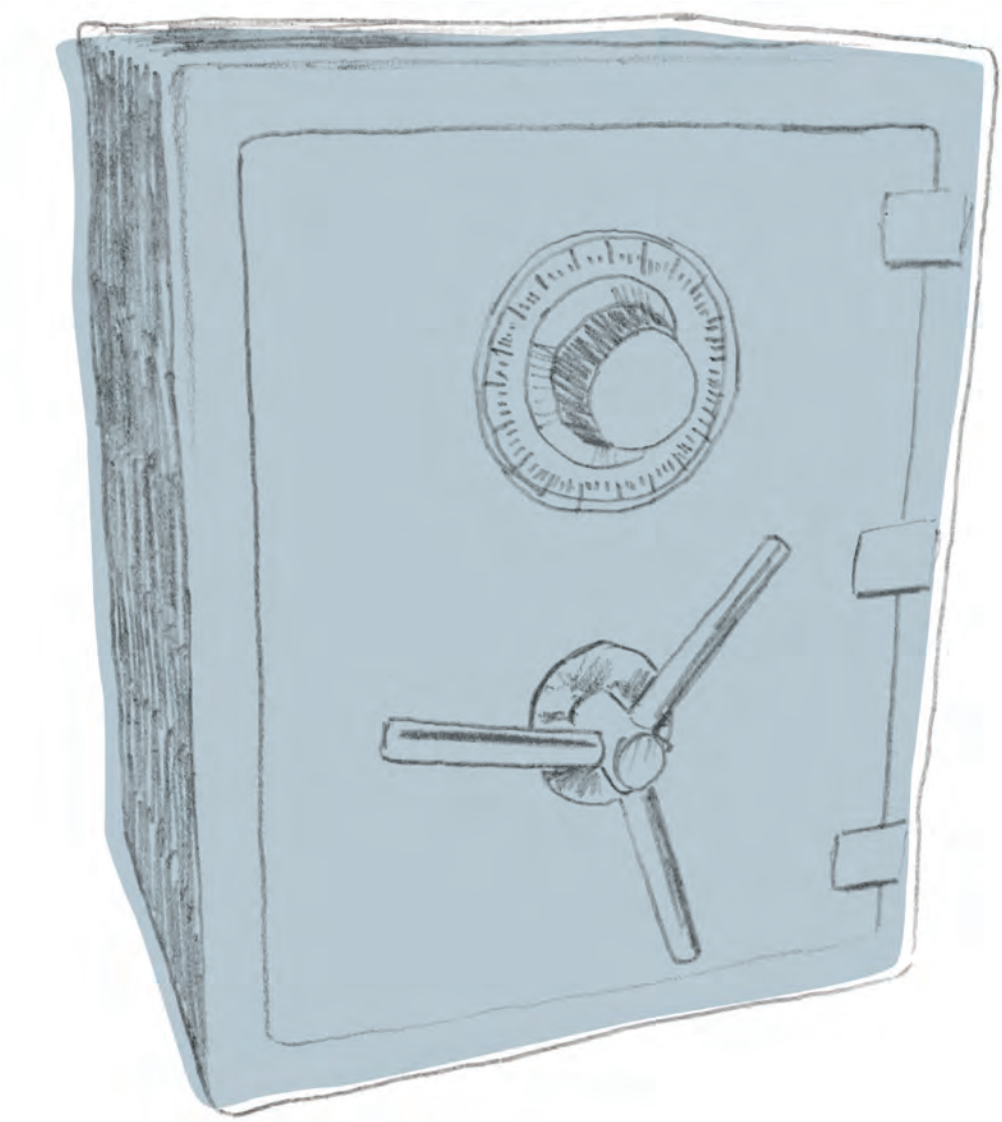
This audit required 706 audit hours at an approximate cost of $50,832.

Grant Thornton

# Maintaining sufficient reserves to protect your not-for-profit organization

**Spring 2010**



## Contents

# Introduction

For not-for-profit organizations — indeed, for all organizations — maintaining adequate reserves is essential to establishing financial stability. These reserves provide a cushion to deal with operating deficits that may arise because of unexpected events, economic uncertainties or lean funding periods. A number of organizations that did not put aside sufficient funds in the past few years to withstand financial shortfalls — and deliver on their missions — no longer exist today.

Maintaining insufficient reserves can put an organization at risk, but maintaining excessive reserves can also be problematic. A number of organizations have been criticized for retaining excessive reserves. So what level of reserves should not-for-profit organizations maintain within their net asset balances? This is an age-old question asked by many not-for-profit organizations and their various constituencies. This paper offers some practical guidance to organizations that wrestle with this issue. As we broaden our discussions, we seek comments from the not-for-profit community on this important topic.

**Acknowledgements**
I would like to thank the more than 50 not-for-profit leaders throughout the United States who read the first draft of this white paper and shared their wisdom and insights as I developed the final version of this document. These individuals included board members, CEOs, COOs and CFOs of not-for-profit organizations, as well as not-for-profit accountants, attorneys, bankers, fundraising specialists and other professionals. I would also like to thank my not-for-profit partners and senior managers at Grant Thornton who shared their experience and feedback with me as I developed this document.

Frank L. Kurre, National Managing Partner,
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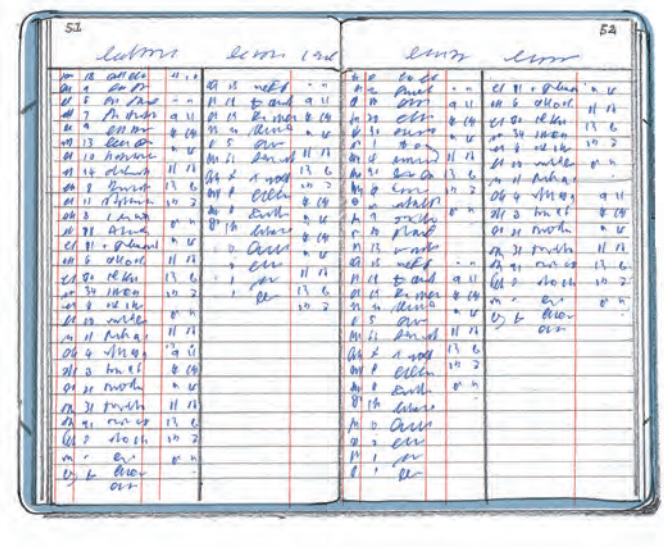
# Defining net asset categories

Not-for-profit organizations maintain net asset balances (assets minus liabilities) based on donor intent or the lack thereof. Net assets typically fall into one of three categories: unrestricted, temporarily restricted or permanently restricted funds.

- Unrestricted net assets are available for the general operations of an organization and have not been restricted by outside donors.
- Temporarily restricted net assets are restricted by donors for certain purposes and/or for future time periods. Once these restrictions have been met, the funds are released as unrestricted net assets.
- Permanently restricted net assets are to be maintained in perpetuity; their income may be used for general operations or specific activities based on donor intent.



Since temporarily and permanently restricted funds can only be spent based on donors' instructions, management and the board typically do not have discretion to spend these donor-restricted monies for purposes other than those the donors intended.

Boards have more flexibility when it comes to unrestricted funds as opposed to restricted assets such as endowment funds. Boards can establish and designate several subcategories within unrestricted net assets. For example, boards can designate their organization's unrestricted net assets into funds for certain program activities or future time periods. Board-designated funds can also include quasi-endowment funds. Quasi-endowment funds, or funds functioning as endowments, are earmarked by the board — rather than by donors or regulators — to act like permanently restricted funds from which income is available for general operations or certain specific purposes. The board can decide to spend the principal of such funds at any time.

Board-designated funds can also include debt reserve/sinking funds, which are often established to accumulate funds for future debt payments, and plant funds. Plant funds typically include the net book value of property, plant and equipment and related assets, less debt and other related liabilities. Plant funds may also include an accumulation of funded depreciation or other amounts for future fixed-asset replacements. Unlike donor-restricted funds, board-designated net assets can be undesignated by the board at any time.

# Key questions

### Should temporarily and permanently restricted net assets be included when determining reserve levels?

Many not-for-profit leaders ask whether temporarily and permanently restricted net assets should be included in determining an organization's reserves. Operating reserves — funds that are available to support an organization's day-to-day operations — are the appropriate measure to consider. Temporarily restricted net assets that result in additional expenditures beyond normal day-to-day operations — for example, temporarily restricted contributions received to fund nonrecurring activities — should not be considered part of these operating reserves. However, if temporarily restricted net assets fund expenditures that would normally be supported by unrestricted funds, such temporarily restricted net assets should be considered in determining the operating reserves.

Temporarily restricted pledges should be discounted to their present value in computing the amount of operating reserves. For example, pledges receivable that are reflected as temporarily restricted net assets simply because of a time restriction (e.g., pledges to be paid over multiple years) but can be spent for any purpose once received should be considered part of the operating reserves.

Permanently restricted funds should not be considered part of the operating reserves, since the corpus of these funds must remain intact in perpetuity. However, unspent income generated from permanently restricted net assets which are available for the general operations of an organization should be considered part of the operating reserves.

### Are quasi-endowment funds a good idea?

The boards of many midsize and large not-for-profit organizations have designated certain unrestricted net assets as quasi-endowment funds. Many not-for-profit organizations, in fact, have been criticized for maintaining high levels of such designated funds. Often, the income generated from these quasi-endowment funds is desperately needed by those organizations to subsidize their programs. If these organizations were forced to liquidate and spend these funds, it could have a significant impact on their ability to sustain the same level of quality programs and services. Without these board-designated funds, these organizations would no longer exist or would have to restrict their programmatic activities severely, especially during difficult economic times.

### Is there an average percentage that constitutes a reasonable reserve?

Over the years, not-for-profit organizations have used a variety of measurements to evaluate the level of reserves that should be maintained. Some organizations believe that they must maintain the equivalent of at least six months of operating expenses in reserves. Other organizations feel that reserves should equal one to two years of operating expenses.

Applying a general percentage (e.g., one year of operating expenses) as a yardstick to all not-for-profit organizations would be a mistake. Not-for-profits should assess the reasonableness of their reserves based on factors pertinent to their individual situations and the subsectors in which they operate. For example, higher education institutions often rely on significant net asset balances to provide student scholarships, whereas membership organizations may be pressured by their members to maintain a low dues structure and not accumulate significant net asset balances. In addition, some organizations have extensive physical plants, are self-insured, have complex corporate or debt structures, or manage a large labor force. These factors have an impact on the size of the reserves these organizations should accumulate.


### What factors should be considered when determining reserve levels?

While some watchdog agencies have developed their own standards for determining appropriate reserve amounts — and many of these standards are very good — there has not been a national standard established that takes into account the full range of factors that can affect reserves. These factors include, but are not limited to, the following:

- Mission and long-term plans or strategies
- Type of organization — e.g., higher education, religious, social services, museum, cultural, association, foundation or other
- Corporate structure — e.g., sole entity, parent/subsidiary entities, brother/sister entities, loosely affiliated groups, etc.
- Investment in the physical plant — e.g., the facilities owned and/or leased
- Complexities of the debt structure
- Current and future commitments
- Funding sources, including fundraising activities
- Types of programs provided
- Self-insurance
- Workforce compensation and benefits issues

(For more details on these considerations and how they affect reserves, see "Calculating what's right for your organization" on page 8.)

A "prudent-person" measurement should be considered in assessing the appropriateness of reserves: Would a prudent person, exercising due care and proper stewardship over the organization's resources, set aside such a level of reserves? The organization should also use an independent and competent board of directors or advisory committee as a safe harbor in determining whether the prudent-person rule has been followed.

### What constitutes excessive reserves?

Over the past several years, many religious organizations have been criticized for maintaining large net asset balances. While at times the criticism has been justified, often it has not taken into account the needs and circumstances of these organizations. Simply applying a measure such as one year of operating expenditures as a yardstick for determining operating reserves lacks understanding of the complexities these organizations face. For example, many religious and higher education institutions are heavily invested in aged facilities, which are reflected at little or no book value on the institution's statement of financial position. In these cases, the accumulation of reserves in a board-designated plant fund to cover future replacement costs, pay for extensive repairs and renovations, or fund depreciation is a wise business decision to ensure that operations continue effectively and without interruption.

In addition, many sophisticated not-for-profit organizations partially or fully insure for certain risks, such as casualty losses or workers' compensation claims. This may require setting aside additional reserves depending on the nature of the self-insured risks. Organizations may also set aside funds in a board-designated sinking fund in order to pay off debt. All of these types of board-designated funds are prudent set-asides that should not be viewed as part of operating reserves. Establishing reasonable reserves which can be supported by management is an appropriate and necessary business decision. However, board-designated net assets should not be used to hide excess reserves. For example, designating unrestricted net assets "for future programs" without having a specific plan for those funds could be considered by some to be an attempt to hide excess reserves. Such excess reserves should be included as part of the unrestricted undesignated net assets.

### Is a surplus problematic?

Many of the factors used by analysts in evaluating public companies should be considered in evaluating not-for-profit organizations as well. Among them is the reality that surpluses should and must be generated in order to support current program activities and plan adequately for the future. A solid foundation and adequate reserves are necessary to ensure the long-term viability of the organization. While public companies are rewarded by rising stock prices and earnings per share when their companies are well-managed, not-for-profit organizations with strong balance sheets are often criticized.

There are two myths that influence the thinking of many individuals. The first myth is that not-for-profit organizations should not generate a surplus, that somehow this is a bad thing. On the contrary, surpluses are needed to sustain the long-term viability of an organization and fund its future programs. Well-managed not-for-profit organizations should be generating surpluses.

The second myth is that not-for-profit organizations should not accumulate significant assets and net assets. We all know that not-for-profit organizations are mission-driven and not profit-driven. However, to sustain their missions and execute their programmatic activities effectively, organizations must also:

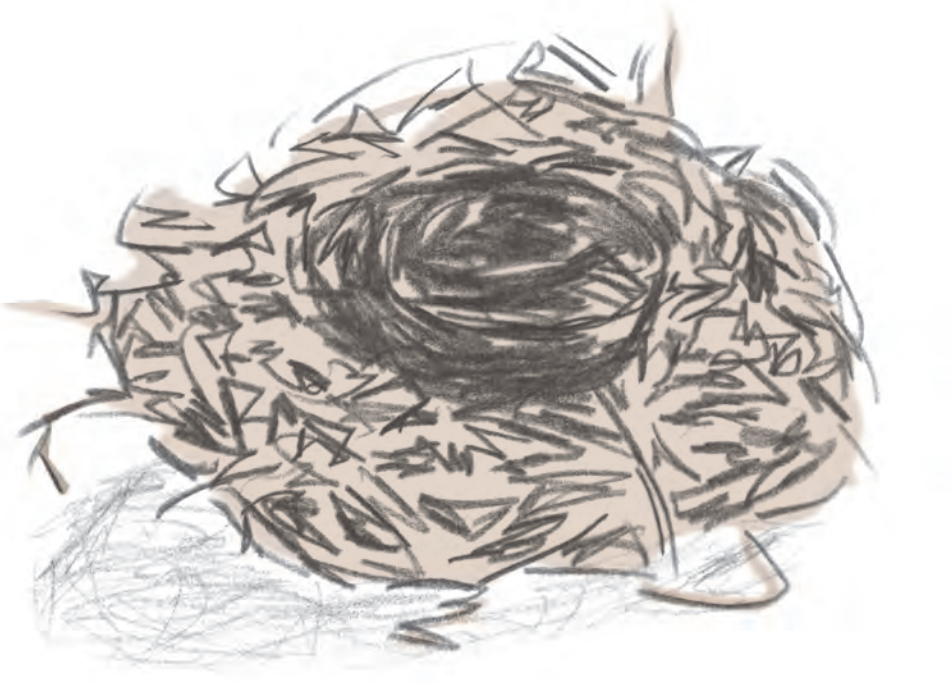
- ensure that adequate financial resources are raised and sustained in order for organizations to fund their programs,
- closely monitor operating and capital budgets and take steps to ensure that organizations operate within those budgets,
- ensure adequate liquidity to avoid a cash crunch and disruption in operations, and
- maintain strong internal control systems.

# Establishing a formal reserves policy

Boards and management teams should apply the same principle when investing a not-for-profit organization's operating reserves that they apply to their personal retirement accounts: The shorter the period until retirement, the more conservative the investments. Accordingly, to the extent that a portion of the operating reserves will be needed in the short term, that portion should be invested in more conservative investments. Reserves that are expected to be invested over the long term can be invested in a more diversified portfolio.

Many not-for-profit organizations have not established a formal reserves policy. They should. This policy should clearly articulate and link to the mission and activities of the organization. It should also be discussed with and approved by the governing board. In addition, management should consider establishing a comprehensive reserves plan linked to the strategic plan and annual operating and capital budgeting processes. The plan should be monitored by the organization's finance or audit committee on an ongoing basis and discussed periodically with the full board.

Once the reserves plan is finalized, it should be publicized to both internal and external constituencies. This plan can help development personnel and board members more clearly articulate why their organizations are "not rich" and why specific funds have been placed in reserves or other set-aside funds.



# Conclusion

The importance of maintaining adequate reserves cannot be overstated. With so many constituencies relying on the work of not-for-profit organizations, it would be fiscally irresponsible not to accumulate and maintain an adequate level of reserves. The recent protracted recession further demonstrates the importance of maintaining sufficient reserves to survive and sustain operations through turbulent times.

But many not-for-profit organizations have never asked themselves, "What level of reserves is adequate?" Boards and management that have not already done so need to assess what levels of reserves their organizations require given their missions and plans, facilities, structures, funding sources, and a number of other considerations. By looking carefully at their needs and establishing a business case for reserves that may be larger than typical, organizations can avoid accumulating unduly excessive reserves, which may damage the organization's reputation. The ultimate objective of maintaining appropriate reserves, of course, is to ensure the long-term viability of the organization and the sustainability of the programs it provides.

**Where we go from here**

Our plan is to build upon this initial document based on the collective wisdom and experience of not-for-profit board members and senior executives throughout the country. The next phase of our effort will be to develop a template to assist not-for-profit organizations in formally documenting both their reserve policies and their reserve plans. We will then work with the not-for-profit community to create a flexible tool that organizations can use in determining their necessary level of reserves.

Once the tool is finalized, we will be able to develop benchmarks regarding how not-for-profit organizations in different subsectors with different characteristics measure their reserve levels compared with peer and aspirant organizations. We hope that our work in this area will be a major contribution to the not-for-profit sector as organizations plan for the future.

# Appendix: Calculating what's right for your organization

### Mission

In determining the adequacy of reserves, one must first consider the mission of the organization as well as its long-term plans and strategies. The mission and long-term plans and strategies should serve as the foundation in assessing whether reserves are adequate but not excessive.

### Long-term plans

Organizations with plans that include the acquisition or maintenance of a significant number of facilities typically require higher levels of reserves. If the plan is to save up over a period of time to acquire a building, such an accumulation of funds would typically be considered normal and reasonable. If the plan is to erect a Taj Mahal-type facility, this may not be prudent and could be considered excessive. If the plan is to acquire a facility to operate programs effectively, the accumulation of funds for such a purpose would typically be considered prudent and reasonable. Another question to consider is how donors would react to what you are doing. This is a good yardstick in assessing the appropriateness of the accumulation of reserves.

### Type of organization

In assessing the adequacy of reserves, consider the type of organization. Certain types of entities, by their very nature, require higher levels of reserves than others. In general, the more complex the organization, the higher the level of reserves. For example, multinational not-for-profit organizations often require higher levels of reserves than similar organizations that are located in only one country.

### Corporate structure

Corporate structure also affects the level of reserves. Typically, the more complex the corporate structure, the higher the level of reserves that are needed. "Parent" entities that have a number of subsidiaries or affiliates often hold reserves for their "children" at the parent level. The parent uses these reserves to provide operating, capital and special purpose (often nonrecurring) subsidies to these subsidiaries and affiliates. In assessing reserves in this case, one needs to evaluate the reserve amounts that are needed for the entire group of affiliated entities, not just the parent entity. Loosely affiliated groups of organizations sometimes support each other's needs. This may also affect the level of reserves.

### Investment in physical plant

Many not-for-profit organizations have large investments in physical plants and/or extensive leased facilities. The need to replace, renovate or repair such facilities places a significant burden on these organizations and requires the maintenance of significant reserves. The establishment of reserves to replace or renovate aging facilities is proper and prudent. One cannot just hope that there will be funds available many years into the future; rather, it is important to plan for and accumulate such funds now for when they are needed.

### Complexities of the debt structure

Organizations often have complex debt structures. Many organizations have public debt outstanding as well as lines of credit, mortgages and other types of debt. The amount of debt that organizations carry has significantly increased over the past 20 years. As a result, higher percentages of operating budgets are being spent to make principal and interest payments on outstanding debt, which takes away from a not-for-profit organization's ability to fund other program expenditures. The establishment of reserves to fund future principal and/or interest payments is a prudent way to manage. The recent illiquidity in the marketplace — and the impact of that illiquidity on not-for-profit organizations in the auction-rate securities market and other markets — further demonstrates the need to maintain adequate reserves and permit flexibility in working through such problems.

### Current and future commitments

Current and future commitments may affect reserves as well. The need to fund commitments — be they contractual obligations, banking requirements or other commitments — may necessitate additional reserves. Banks often require that certain funds be set aside to secure debt, maintain loan covenants or support loan guarantees.

### Funding sources, including fundraising activities

The type of funding an organization receives also has an impact on the level of reserves that are necessary. Organizations that have stable revenue streams typically require less in reserves than those whose revenue streams are subject to significant fluctuation. Organizations that operate in a competitive environment with other not-for-profit organizations — and possibly with commercial companies — typically require higher levels of reserves. Not-for-profit organizations that are reliant on only one source of funding, such as fundraising or government contracts, may require additional reserves to protect against a drastic reduction in such funding.

### Types of programs provided

The types of programs provided may also affect the level of reserves. Multiple-location operations may require more extensive reserves than single-site programs. Programs that require significant up-front investment or require the organization to match government funding or foundation grants may also require higher levels of reserves to sustain programs.

### Self-insurance

Certain sophisticated organizations self-insure for medical, casualty and workers' compensation claims. Such organizations require the establishment of liabilities to cover known claims as well as "incurred but not reported claims." In addition, it is often prudent for such organizations to set aside additional reserves in order to manage any significant deterioration in claims experience or increases in reinsurance premiums.

### Workforce compensation and benefits issues

The size and complexity of an organization's workforce may also have an impact on the level of reserves that are required. Organizations that are considering workforce reductions or retraining/redeployment actions may need to maintain specific reserves to subsidize such efforts, especially in difficult times. These organizations may also want to consider maintaining additional reserves to cover unfunded pension and postretirement liabilities.

# For more information

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This paper is meant to encourage not-for-profit board members, management and other individuals to consider the matters I have raised. I would appreciate any and all comments on this document and any suggestions you might have on developing appropriate yardsticks for determining the adequacy of reserves. We will incorporate many of the suggestions received in response to this document in our future publications. Please feel free to send your comments and recommendations directly to me at Frank.Kurre@gt.com

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2012

# Mediating Incentive Use: A Time-Series Assessment of Economic Development Deals in North Carolina

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Upjohn Institute working paper ; 12-184

W.E. UPJOHN INSTITUTE
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# Mediating Incentive Use: A Time-Series Assessment of Economic Development Deals in North Carolina

**Upjohn Institute Working Paper 12-184**

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April 12, 2012

## ABSTRACT

State incentive granting for the purpose of firm retention or recruitment remains highly controversial and is often portrayed as antithetical to long-range economic development planning. This paper uses quasi-experimental methods to measure the impact of state-level economic development incentives on employment growth at the establishment level in North Carolina. Using North Carolina's rich history of strategic planning and sector-based economic development as a backdrop, we develop a theory of sectoral "mediation." This enables us to compare the effectiveness of incentives offered in mediated and nonmediated industries and show that when incentives are coupled with sectoral economic development efforts they generate substantially stronger employment effects than at establishments with limited sector-based institutional support.

**JEL Classification Codes:** O20, O25, O43, R58

**Key Words:** Incentives, mediation, employment impacts, firm retention, recruitment

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**Mediating Incentive Use:**
**A Time-Series Assessment of Economic Development Deals in North Carolina**

## 1. INTRODUCTION

As state governments throughout the United States face unprecedented fiscal crises, every public program—from education to pensions to prisons—has come under intense scrutiny and is a potential target for budget cuts. But even as the pressure to reduce state spending has increased, the need for job creation has intensified, as unemployment remains stubbornly high in the aftermath of the Great Recession. Thus, economic development practitioners who are charged with bringing new employment opportunities to their communities face a sharp tension. On the one hand, there is pressure to use their most common and most tangible tool—direct tax incentive payments—when negotiating with mobile businesses to "win" jobs for local residents. Simultaneously, critics of economic development incentives claim that such payments are unnecessary giveaways to the private sector and should not be used while basic services such as education and health care are being cut.

To further complicate the issue, many scholars argue that using direct incentives is antithetical to a more strategic approach to economic development that entails public funding for industry-wide support systems such as key infrastructure projects, research and development facilities, technology centers, or state-of-the-art workforce development systems. Although the theoretical and empirical literature on economic development incentives is rich (Bartik 2005; Greenstone and Moretti 2003; also see, for example, Markusen 2007; Persky, Felsenstein, and Wiewel 1997; Peters and Fisher 2004), this paper engages the incentive debate in a novel way. Specifically, we conduct a quantitative assessment of the effectiveness of state incentives in creating sustained employment opportunities. However, we present this analysis of incentive use

within the context of existing state-level economic development practices that have developed in our case state of North Carolina over the past several decades.

North Carolina has a long track record of public-private partnerships and state-led efforts to promote economic development through common-pool industry resources. Early examples of this include the development of the Research Triangle Park (RTP) and a relatively strong commitment to higher education; more recently, there have been experiments in regional and sectoral initiatives in the 1980s and 1990s. Incentive use in North Carolina is even more recent: North Carolina initiated its first statewide statutory tax incentive program in 1996—the William S. Lee Tax Credit Program—and only began its two major discretionary incentive programs in 2000 (One North Carolina Fund) and 2003 (Job Development Investment Grants [JDIG]).

Given the state's recent adoption of incentives and its unique policy history, North Carolina is an ideal setting in which to test the effectiveness of incentives in creating and sustaining job opportunities in the long run. Instead of comparing incentive use to a fictional, counterfactual reality where no incentives are given, this paper explores the question of whether economic development incentives are more effective when they are used as inducements to industry, or whether they are better used to support sector-wide functions of long-range strategic planning.

This paper employs a quasi-experimental research design to measure the impact of incentive granting on employment growth at the establishment level, using a data set of nearly all state-level incentives granted between 1996 and 2008. Incentivized establishments are matched to the National Establishment Time-Series Database (NETS) for North Carolina, which contains longitudinal information on employment as well as the highly detailed establishment characteristics needed to construct a set of realistic control groups. We measure the impact of

retention incentives using an interrupted time-series research design that compares pre- and post-trends in employment at "treated" establishments to a set of control establishments selected by peer industry establishment size.

Specifically, this analysis compares "deals" made in industries that are the focus of traditional long-term economic development planning activities such as state-funded research centers, workforce development initiatives, and joint industry-state planning agencies, to those deals that occur in other sectors. We employ the term "mediated industries" to distinguish these sectors from others that lack more coordinated development activities. Thus, the main research questions posed address not only the straightforward policy question of "Do economic development incentives induce growth?" but also the more specific question of "In which context are incentives more likely to induce growth?" In addition, we make a similar set of comparisons for incentives that flow to firms recruited from outside of North Carolina. Since we lack pre-incentive employment observations for this set of incentives, we employ a modified research design that builds a control group using a nearest-neighbor matching technique based on each establishment's unique characteristics, including birth year, industry, mobility, and ownership structure.

Ultimately, we find that both the retention and recruitment incentives offered by the state of North Carolina positively influence future employment growth at the establishment level. However, the positive impacts are concentrated in sectors that are directly or indirectly connected to sector-specific planning efforts. These findings have significant implications for both policymakers and theory. First, we interpret the empirical results as evidence of the effectiveness of state-level industry mediation in general, which implies that state funding for long-range strategic and sector-based planning efforts should be maintained and even expanded.

Second, this analysis indicates that incentives are efficient when used in the context of broader supports for economic development—including support for common pool resources across key industries—and should not be viewed by theorists as strictly antithetical to sound economic development practice.

The remainder of this paper is organized as follows. Section Two lays out the policy background of incentive use in North Carolina and presents our theory of how state actors engage in "mediating" incentives within certain targeted industries. This section also summarizes previous empirical analysis of the impact of incentives on employment. Section Three describes the data sources used and the assumptions made in constructing our matched panel data set from NETS and presents summary statistics that describe incentive use in North Carolina over the study period. Section Four presents two distinct methodologies for detecting employment impacts in both retained and recruited firms in North Carolina. Section Five presents the main empirical findings and discusses the robustness of these findings. Section Six concludes and presents our interpretation for policymakers and theory.

## 2. BACKGROUND AND LITERATURE REVIEW

### 2.1 State Economic Development Strategy and the Evolving Use of Incentives

After a long period of reluctance on the part of lawmakers, North Carolina is now a significant player in the incentive game nationally. The North Carolina General Assembly took initial steps to authorize incentive use for economic development in the early 1990s. The legislature created the Governor's Industrial Recruitment Competitiveness Fund in 1993 to provide matching funds to local governments to expand the capacity of local incentive granting. Then, in 1996, the North Carolina Supreme Court ruled in Malready v. The City of Winston-

Salem that tax credits and cash grants were constitutionally permissible when used for economic development by both state and local governments.

North Carolina initiated its first statewide statutory tax incentive program in 1996 under the William S. Lee program. As first enacted, the William S. Lee Act provided a series of entitlement incentives—tax credits for any firm choosing to locate, create jobs, and provide investment in North Carolina. In order to promote investment outside of the state's wealthier urban counties, the statute directed larger credit amounts for those firms locating in more economically distressed counties, designated by five tiers, ranging from the most distressed (Tier 1) to least distressed (Tier 5).[1] Additionally, the state attached strict performance criteria and clawback mechanisms to these credits in order to ensure that firms lived up to their promised job creation targets in exchange for the public subsidy. Ultimately, the Lee Act was repealed and replaced by a series of new entitlement tax credits (most notably, Article 3J credits for job creation).

As mentioned in the first section, North Carolina also has two major discretionary incentive programs, including the OneNC Fund (the renamed and expanded Governor's Industrial Recruitment Competitiveness Fund) and the Jobs Development Investment Grant, or JDIG, program, created in 2002). In its current form, the OneNC Fund provides matching grants to local governments to increase the amount of incentives that local governments can offer for retention, expansion, and recruitment deals. Although any unit of government across the state may apply for OneNC funds, the program's matching structure is intended specifically to benefit the most distressed counties, which would otherwise have less fiscal capacity to offer competitive incentives. Unless paired with a JDIG grant, OneNC funds are normally disbursed in

four equal tranches over a three-year period, subject to strict job creation accountability provisions (North Carolina Department of Commerce 2012).

JDIG, the state's flagship program, is a performance-based incentive program that provides annual grant distributions to a maximum of 25 qualifying firms per year for a period of up to 12 years for the purpose of supporting retention, expansion, and recruitment. Unlike the OneNC Fund, the JDIG provides cash grants directly to the recipient firms, based on a percentage of the withholding taxes paid by new employees during each calendar year. In effect, the program avoids the constitutional limitations on tax incentives by providing cash assistance equal to the value of the taxes paid by employees, thus tying the grant obligation to the firm's performance in job creation. JDIG grants possess strong wage requirements, performance criteria, and clawback mechanisms, which the state has not hesitated to employ in the 14 cases (as of 2012) in which a firm has failed to meet to its job creation targets. Given the 12-year disbursement period, none of the grants have been fully disbursed to recipient firms, so total job creation and investment totals are currently incomplete.

Beyond the state-level programs, many local governments in North Carolina offer their own incentives, usually in the form of cash grants or constitutionally appropriate tax breaks, but little is known about their scope, scale, or effectiveness. To remedy this knowledge gap, the General Assembly passed legislation in 2011 requiring the Department of Commerce to track and report local incentive activity on a quarterly basis.

### 2.2 North Carolina's Incentive Use in a Theoretical Context: Explaining Mediation

While industrial recruitment has a long history in North Carolina, as the above section suggests, the use of incentives to attract and recruit individual firms is a fairly recent practice, especially when compared to other Southern states that have been in the incentive-granting game

since the 1930s. Prior to the 1990s, North Carolina chose instead to give priority to investments in institutions and infrastructure that could make the state an attractive location for business development, be that locally driven or through recruitment efforts involving outside establishments. As early as the 1920s, North Carolina state government invested heavily in transportation infrastructure, paving more miles through state funding than virtually any other state in the nation and earning the moniker "The Good Roads State." In 1959, North Carolina created the Research Triangle Park with the goal of increasing good-quality employment opportunities for graduates of the region's preeminent universities (Link 1995; Rohe 2011). In the 1960s, North Carolina established one of the nation's first state-level science and technology advisory boards, whose primary mission was to advise the governor on science and technology policy across the state (Feldman and Lowe 2011).

Under Gov. Jim Hunt, the North Carolina Board of Science and Technology recommended the formation of several high-profile economic development and educational institutions, including the Microelectronics Center of North Carolina and the North Carolina School of Science and Mathematics. During that time, the Board also established and managed the North Carolina Biotechnology Center, the nation's first state-funded economic development organization to support life-sciences industry development, eventually spinning it out as a quasi-public institution (Feldman and Lowe 2011). In the 1990s, regional coordination of economic development was institutionalized by the state legislature through the creation of seven regional partnerships designed to align local development priorities and resources. In addition to these developments, North Carolina has built an impressive community college system that is considered to be one of the more inclusive and better functioning in the nation (Osterman and Batt 1993).

Broadly speaking, each of these initiatives has contributed to common-pool resources for promoting and supporting industrial development in North Carolina. With this contribution in mind, scholars and analysts alike are often quick to dismiss North Carolina's more recent foray into incentive granting as a step backwards and as antithetical to this earlier, more progressive policy tradition. Many analysts lament the recent policy shift towards incentive granting, claiming that it even undermines the strategic work of earlier generations. At times, this impression is reinforced through media accounts of incentivized recruitment and retention deals in which public officials make apologetic statements about their reliance on incentives to attract or retain industry. These statements reflect a common narrative that North Carolina was forced to lower its economic development standards after losing several high profile recruitment deals to neighboring states that offered sizable incentive packages.

Although there is likely some truth to this "race to the bottom" characterization, it also overlooks important elements in the evolution of economic development policy in this state. First, the conventional narrative gives the false impression that North Carolina, in limiting earlier incentive use, had also avoided recruitment and retention strategies altogether. On the contrary, retention and recruitment have long played a role in economic development in the state; a recent biography of Governor Hunt—a much-praised, four-term governor who was instrumental in strategic planning efforts—acknowledges that he dedicated considerable time while in office to marketing the state to outside industrial prospects (Grimsley 2003). Second, the conventional account discounts the fact that the emergence of incentive-granting processes is grounded in the state's well-established institutional infrastructure, which earlier forms of strategic planning helped to create. These interconnections help to establish standards within the incentive-granting process itself and, more importantly, contribute to structures for mediating the relationship

between incentive use and development outcomes over time. As this suggests, there are spheres in which new and old policy efforts intersect and even complement one another. By recognizing this, we can turn our focus to areas of overlapping strategy and consider the implications this may have for long-term development planning.

In this paper, we analyze two types of interactions between incentive-granting and established strategic planning efforts. The first interaction is information-intensive, reflecting the use of analytical tools and techniques by local and regional economic development practitioners and analysts in an effort to better guide and evaluate incentive-granting processes. In North Carolina, as elsewhere, this is primarily achieved through **industry or sector targeting**—that is to say, concentrating economic development efforts in industries that demonstrate high growth potential for the region. Industrial or sector targets are typically generated through rigorous statistical analyses, which take into account the industrial legacies and characteristics of the regional economy (Bartik 2005). This can include the use of growth models that factor in existing supply chains, workforce skill specializations, and export performance. In some cases, analyses also include inventories of regional support institutions designed to nurture and support targeted industry (Cox et al. 2009). Targeting efforts can be beneficial for channeling public resources to entrepreneurial development (Woodward and Guimarães 2009). However, they are most commonly associated with strategies of industrial recruitment and retention and, by default, the application of incentives (Goetz, Deller, and Harris 2009).

In the North Carolina context, industry targeting has been especially visible at the multicounty regional level. Although state development agencies frequently acknowledge industries of interest for the entire state, the tendency is to decentralize explicit targeting efforts to the regional level, given North Carolina's diverse industrial landscape and regionally varied

economic strengths. Still, state agencies actively support regional targeting efforts. As one illustration, North Carolina's Department of Commerce in 2001 provided each of the state's seven regional partnerships with funding to conduct in-depth economic analyses of their regions, in an effort to identify existing and emergent industrial strengths. The goal of this exercise was to encourage regions to channel state and local resources to activities that supported targeted industry development and revitalization, including, but not limited to, firm recruitment and retention.

The second relationship between incentive granting and strategic planning that we explore involves **institutional mediation.** By institutional mediation we mean active involvement by sector-oriented institutions in mediating and governing incentive-backed recruitment and retention activities. As this implies, mediation efforts are closely linked to targeting strategies, insofar as the mediating institutions also have a sector or industry focus. But institutional mediation goes beyond efforts to simply inventory or catalog industry-support institutions. Rather, mediation implies active engagement by those same institutions in planning processes designed to guide and moderate sector-specific recruitment and retention efforts. This includes playing an active role in establishing and maintaining strong relationships with firms before, during, and after the recruitment or retention deal-making period. In the case of firm recruitment, institutional engagement also means developing relationships with industrial prospects well before there is a need for a new facility and structuring those early conversations in ways that shape later perception of or interest in North Carolina.

Other mediation activities include tracking and responding to ongoing and emergent sector challenges and constraints—an information-gathering and assessment task that is itself dependent on the maintenance of close relationships with networks of firms within the sector.

Additionally, institutional mediation entails coordination of economic development planning across multiple levels of decision making and across distinct areas of development strategy. By this we mean that mediating institutions ensure that recruitment and retention activities are not performed in isolation, but rather are shepherded in a way that ratchets up standards for how incentive-backed deals get made, regardless of whether the locus of deal-making is at the local, regional, or state level. However, to an equal extent, mediated institutional support entails stitching together and aligning recruitment, retention, and even entrepreneurial efforts, and doing so in ways that motivate the development of a cohesive policy "portfolio."

Although this may sound ambitious and perhaps even impossible to implement, it is important to recognize that North Carolina has already embraced institutional mediation and has experienced success, as illustrated in the biomanufacturing sector (Lowe, forthcoming). In-depth case study analysis points to a central mediating role of North Carolina's Biotechnology Center, an institution long associated with North Carolina's strategic planning efforts. Since its creation in 1981, the Biotech Center has supported research and development activities through a variety of grant, loan, and industry networking initiatives. Over the decades, the center has also assisted in the recruitment of preeminent scholars in an effort to further enhance university research—an early example being Prof. Oliver Smithies, who went on to win a Nobel Prize in physiology in 2007. In addition to these successes, the Biotech Center has formalized its role in industrial recruitment and retention, establishing itself as a leading institution for strategy development. Furthermore, the center approaches this task in partnership with North Carolina's Department of Commerce and the state's community college system, with each entity playing a unique but complementary role in strategy development and implementation.

By mediating recruitment and retention efforts, the Biotech Center, with the help of these core institutional partners, has been able to better anticipate and thus prepare for recruitment opportunities. In addition, it is in a position to identify and resolve emergent industry challenges that have the potential to affect firm retention over time. In considering both recruitment opportunities and retention challenges, the Biotech Center has concentrated on improving industry support institutions, especially in the area of technical training and education. In partnership with the community college system, the Biotech Center has enhanced the quality of manufacturing establishments recruited to the state and motivated firms that locate in North Carolina to experiment with innovations in life science manufacturing. By working closely with the Department of Commerce, the Biotech Center also ensures strong coordination between state and local economic development planning efforts; such coordination includes empowering local practitioners to uphold industry recruitment standards based on job-quality concerns and evidence of a strong fit between an industrial prospect and the practitioners' community. Ultimately, the mediated approach taken by the Biotech Center and its partners encourages sustained manufacturing job growth and promotes regional advantages that ultimately reinforce industry stickiness and staying power.

Drawing inspiration from biomanufacturing, experiments in institutional intermediation are underway in other sectors and industries in North Carolina, most notably in advanced textiles, including nonwovens and—more recently—aerospace. This presents an opportunity to systematically examine the impact of institutional mediation on incentive-backed recruitment and retention. Before turning to this analysis, it is useful to first situate our work in relation to other quantitative studies in this area.

## 2.3 Previous Empirical Analysis of Incentive Impacts

The literature on the economic impact of state economic development incentive use is extensive but remains unsettled in terms of the overall assessment of incentives; this ambivalence is mirrored by the ongoing controversy over incentives in practice. From the standpoint of an ideal research design, analysts and policymakers would wish to answer the so-called "but for" question with regard to incentives (i.e., *But for* the incentive, would the firm have come or have been retained?). In fact, most careful cost-benefit analyses of incentives hinge on this very question. However, it is nearly impossible to answer this question absolutely given that the analyst cannot know the exact nature of each firm's location decision *a priori* and that firms are never randomly assigned an incentive, which makes it difficult to generate coherent control groups.

Despite these challenges there have been many attempts to evaluate incentives indirectly. For example, some researchers have focused on state- or county-level aggregate outcomes such as employment growth and changes in tax revenue, comparing areas that spend more or less on development incentives. Goss and Phillps (1997) show that state spending on economic development incentives is positively associated with employment growth across the United States, and Loh (1993) finds that Ohio's incentive grants in the 1980s made a positive impact on county-level employment and income growth. In a detailed analysis of highly competitive economic development deals in the United States, Greenstone and Moretti (2003) overcome the problem of endogeneity between the intensity of public incentive-granting and employment by comparing county-level outcomes for communities that won a "million-dollar plant" to those of counties that bid for but did not complete the deal. They find that total earnings grew 1.5 percent faster for incentivized industries in winning counties than for such industries in those counties

that lost the plant. However, a more recent analysis of Michigan's MEGA tax incentive program (Hicks and LaFaive 2011) found no statistically significant impact on county-level income, employment, unemployment rate, or wages.

Although the majority of research has focused on impacts at an aggregate areal level—largely because of limitations in obtaining establishment-level outcomes—some papers have attempted to measure the impact of incentives at the firm or establishment level. For example, Faulk (2002) uses firm-level data from corporate tax returns to estimate the employment impact of Georgia's Jobs Tax Credit program from 1993–1995. This study compared employment change in eligible firms that participated in tax credit programs to employment change in eligible firms that did not participate in tax credit programs and found that firms taking advantage of the tax credit created 23–28 percent more jobs.

However, these incentives are not discretionary, in the sense that offers are made by public officials to a single firm, so it could be that firms that were planning to add jobs in the future were simply more likely to participate in the program. Similarly, Gabe and Kraybill (2002) analyzed the impact of incentives on 366 manufacturing establishments that expanded during the 1980s and showed that incentives actually had a negative impact on subsequent employment change. However, since their data set of both incentivized and nonincentivized observations was drawn only from establishments that were already expanding, their results may be biased downward. This is because their control group did not include firms in similar industries that did not expand locally but either left the region to expand elsewhere or would have added jobs if they had received an incentive.

Overall, while most quantitative assessments of incentives focus on county- or state-level impacts, those papers that do focus on the firm or establishment level often fail to construct an

appropriate control group of nonincentivized firms to generate valid estimates. These highly quantitative assessments tend to focus on one form of economic development policy—incentives—in isolation and make no attempt to understand the potentially critical interaction between recruitment or retention policy and other long-range strategic planning efforts. This paper advances the empirical literature on incentives in two ways. First, we conduct our analysis at the establishment level using time-series data for (nearly) all establishments in North Carolina that allow for the construction of a reasonable set of controls. Second, by comparing the impact of incentives in sectors of the economy that are the focus of state-led planning efforts, we can provide empirical evidence of the effectiveness of such planning efforts in a general sense. This is particularly interesting since it is often difficult for policymakers to demonstrate the effectiveness of broad-based institutional supports for economic development. Therefore the research design proposed below will allow us to make an estimate not only as to the impact of incentives on employment growth, but also as to the broader impact of industry mediation in the process of economic development.

## 3. DATA SOURCES

### 3.1 Database Construction Steps

As we said above, a key aspect that distinguishes this paper from previous quantitative analyses is the focus on employment effects at the establishment level using quasi-experimental methods that isolate the causal impact of the incentive itself on future job growth. To conduct this analysis we use two major sources to build a time-series database of observations for those establishments that received an economic development incentive and a time-series database for those that did not—our two control groups. First, we use data on incentive grants obtained from

a comprehensive media study of announced deals generated by the University of North Carolina's Kenan Institute. This database was constructed by searching all major newspapers in the state for announced incentive deals from 1996 to 2006. This data set contains information on incentives that involved discretionary funding from the state—primarily from the OneNC and JDIG programs—but does not include grants made exclusively by local government.[2] The media survey contained 387 total incentives during the study period, consisting of 173 retention grants and 214 recruitments. This database also recorded the date of announcement, the total incentive amount (state and local match), the expected number of jobs created, and the county in which the project occurred. To ensure that the media survey covered the full extent of state incentive grants, we compared the database to annual reports from the North Carolina Department of Commerce covering the name of establishment, incentive amount, and promised and actual job creations.[3] These combined sources were used to define the set of "treated" establishments and the key variables of interest—the timing of the incentive (year) as well as whether the incentive was a retention or recruitment deal.

Next, we matched our treatment set of incentive establishments to the National Establishment Time Series (NETS) database. The NETS has the distinct advantage of offering a consistent time-series of observations on employment between 1990 and 2008; this series provides a host of establishment characteristics on which we rely to construct a set of control samples of similar, nonincentivized businesses. Although the NETS database is used with increasing frequency in academic research (Lester 2011; Neumark, Zhang, and Wall 2005) it is useful to provide some background here. The NETS is a longitudinal data set privately produced by Walls and Associates based on 19 annual snapshots of the Dun and Bradstreet (D&B) business-listing and credit-rating service. Because it is based on information from D&B—which

has a strong economic incentive to reach every business—the NETS is a near-census of business establishments in the United States. While the measurement of employment levels at establishments has been a concern of some observers, at an aggregate level, employment figures are consistent with trends observed in publicly available sources such as the Quarterly Census of Employment and Wages (QCEW) and the County Business Patterns (CBP) (Neumark et al. 2005). The advantage of using NETS is that information is available at the establishment level on a wide variety of characteristics, including year of birth and death, detailed industry codes (up to an eight-digit SIC), sales, mobility, and branch plant status.

We matched our incentive database to the NETS based on the company name, county, and approximate employment size. Of the 387 incentives, we successfully matched 270 (69.7 percent) to valid records in the NETS database. The primary reason some incentive records were not matched to the NETS is that the official company name in the D&B files differed from the company name listed in the media or in the North Carolina Department of Commerce report. Name discrepancies may arise from recent merger activity or from a name change that is unobservable. In other cases, company records may simply not exist in the NETS, which is a comprehensive but not a 100 percent complete census. What is critical for our purposes, however, is that firms that have gone out of business or moved outside the state are still listed in the NETS database and are therefore captured in our analysis. This avoids the problem of positively biasing our results by screening out failed firms or companies that took an incentive and then moved elsewhere. Ultimately our matched sample has a proportional breakdown of retention and recruitment deals and is similar to NETS in terms of industry sectors. Thus we interpret the matched sample of 270 records as a representative sample of incentivized establishments in North Carolina.

### 3.2 Operationalizing Institutional Support Factors

As indicated in Section Two, a key aspect of this paper is comparing incentive impacts across industry sectors that have benefited from additional state-led strategic planning initiatives. Specifically, we examine differential impacts of incentives in sectors identified by regional planning entities as targeted industries, as well as statewide mediated industry sectors. We define "targets" as industries that were formally recognized in target plans made by each of North Carolina's seven regional economic development partnerships—the multicounty planning organizations designated by statute to help coordinate economic development activities across different regions of the state. In 2000, each regional partnership undertook a cluster identification and strategic targeting planning process that resulted in the identification of selected industries for growth encouragement within the region. We obtained the list of targeted NAICS codes and broke down each region's targets by categorizing them as "existing strength targets"—industries that have an employment location quotient relative to the United States of greater than 1.1—or "aspirational" targets for industries that lacked regional concentration.

However, the critical focus of our paper is on incentives made in those industries that have received significant state intervention over the past several decades. We argue that these industries are examples of state "mediation," and—according to the theory presented in Section Two—we expect that incentive deals within these sectors will perform better than those made in sectors that do not simultaneously receive high levels of institutional support. We define mediated sectors as the life-sciences/biotechnology sector and the advanced textile manufacturing and nonwovens industries. Appendix A lists the NAICS codes of incentivized establishments that we coded as mediated for this analysis.

### 3.3 Incentive Use in North Carolina

Between 1996 and 2008—the period in which our media survey is based—North Carolina engaged in approximately 387 agreements with private companies to either stay or relocate within the state in exchange for state-funded incentives. The pace of incentive-granting increased significantly in 2000 when the JDIG program was initiated. Since 2000, an average of 41 incentive deals have been made each year, with a peak of 75 in 2006. Overall, the average incentive amount offered per job was $23,849, with an average of approximately 200 announced jobs created or retained per incentive. As Table 1 describes, North Carolina favored recruitment deals by a slim margin (55 percent vs. 45 percent). Not surprisingly, incentive amounts were higher, on average, for recruitment deals because there is likely more competition with other states and because existing North Carolina establishments face sunken costs associated with moving outside the state.

**Table 1 Descriptive Statistics of Incentive Use in North Carolina, 1996–2008**

| | All incentives | All matched incentives | Regional target | | Mediated industry | |
|---|---|---|---|---|---|---|
| | | | Yes | No | Yes | No |
| No. of incentive deals | 387 | 269 | 180 | 207 | 68 | 319 |
| % retention | 45 | 54 | 45 | 44 | 51 | 43 |
| % recruitment | 55 | 46 | 55 | 56 | 49 | 57 |
| Average incentive/job ($) | 23,849 | 20,177 | 32,228 | 16,685 | 16,608 | 25,416 |
| Average jobs announced | 199 | 182 | 210 | 189 | 156 | 208 |

SOURCE: Authors' analysis of data from a media study by the University of North Carolina's Kenan Institute, and the North Carolina Department of Commerce.

Examination of incentive use in regionally targeted or state-mediated industries shows that the share of incentives going to recruitment in these industries stays approximately the same. Throughout the study period there were 180 incentives (46.5 percent) made to establishments corresponding to regionally targeted or state-mediated industries; interestingly, the average incentive package offered to targeted establishments was nearly double ($32,228/job) that

offered to nontargeted companies ($16,685/job). This might suggest a greater willingness to pay on the part of state and local officials for the added strategic benefits of a targeted firm (i.e., positive externalities associated with clustering, import substitution, long-term growth potential, etc.), or it may simply reflect greater competition for firms in “rising” industries.

For meditated industries, however, there seems to be an opposite effect on incentive levels. In total, 67 incentives were made in the biotechnology/life sciences and advanced textiles sectors. Mediated incentive deals tended to be significantly lower on a per-job basis—$8,800 less—than those in nonmediated sectors. Although we cannot observe each negotiation process directly, this supports the argument made above and in Lowe (forthcoming) that, in mediated sectors, state actors possess deep knowledge about industry dynamics and emerging technologies in the field. Such knowledge can potentially help bridge the information asymmetry present in most incentive talks with mobile firms. In addition, we hypothesize that the process of mediation helps narrow the potential set of incentivized establishments to those that are a better fit for the region and are thus more likely to build stronger ties within the broader cluster.

## 4. METHODOLOGY

To assess the effectiveness of economic development incentives in maintaining and expanding employment opportunities, and to test the hypothesis that mediation matters, we design two empirical strategies using time-series data on employment at the establishment level. We split up our analysis of incentives in North Carolina based on whether they were devoted to firms that already existed in the state (i.e., retentions) or to attracting new establishments (i.e. recruitments). The primary reason for dividing up the analysis is that our panel data set is limited to observation of employment levels in the years before an incentive for establishments already

located in North Carolina. Thus the recruitment deals have no preperiod in which to conduct a difference-in-differences estimate of the employment impacts of an incentive. Below, we describe the details of our empirical strategy for measuring employment effects for retentions using panel data, and for recruitments using a collapsed data set and a propensity score-matching design to generate appropriate control groups.

**4.1 Retentions**

Our primary empirical strategy for measuring the impact of an incentive grant on employment growth is to use our panel data set to generate difference-in-differences estimates by comparing employment levels in years before and after an establishment received a retention deal. The key independent variable in this approach is the timing of the incentive. Equation (1), below, summarizes the main specification. In this model the incentive variable ( $Inctv_{it}$ ) is coded "0" for each year (*t*) that the establishment (*i*) was located in North Carolina *before* receiving an incentive, and "1" for each year *after* the grant was made. Thus, our analysis only uses the incentive as a dichotomous (dummy) variable and does not include the dollar amount of the incentive, which is sometimes front-loaded and sometimes granted over time.[4] The main outcome variable is expressed as the natural log of employment at the establishment level. Logging the outcome variable will smooth out the differences between employment changes at small and large firms and enable us to interpret the value of $\beta_1$ as a semi-elasticity, the percentage change in employment resulting from changing the incentive status from zero to one.

$$\ln Emp_{it} = \alpha + \beta_1 Inctv_{it} + \gamma_t + \tau_i \quad (1)$$

Model 1 also includes fixed effects for each year ( $\gamma_t$ ) and each establishment ( $\tau_i$ ). The inclusion of year fixed effects controls for any changes in employment that are due to cyclical trends

correlated with time, such as macroeconomic shocks or broad growth trends that affect the entire state. The establishment fixed effects control for any idiosyncratic differences across establishments, which is essential for isolating the impact of the incentive on employment. In essence, the coefficient ( $\beta_1$ ) is estimated solely on variation in employment *within* establishments over time. Thus, we interpret ( $\beta_1$ ) as a difference-in-differences (DD) estimator in that it is created by comparing employment changes in establishments that received an incentive (i.e., where the *Inctv* variable changes from zero to one) to those that never received an incentive (i.e., the control group).

A critical aspect of any difference-in-differences research design is to generate a reasonable set of controls so that we can reliably interpret the coefficient as a result of the policy itself, rather than as a spurious correlation generated by some form of endogeneity. For example, it is reasonable to suspect that state policymakers may favor firms in rapidly growing industries and that an evaluation that compared incentivized firms—which may be in "sunrise" industries—to firms in all other North Carolina industries may simply be picking up on the industry effects. Similarly, we would not want to include in the control group those establishments whose growth is largely tied to population trends, such as industries like restaurants and local retail. Thus, for our control group for the analysis of retention deals we use only those establishments that are in the set of peer three-digit Standard Industrial Classification (SIC) codes that ever received an incentive grant. Similarly, when we analyze incentive deals in either mediated industries or regional targets, we limit the control groups to firms in the narrower set of peer SICs that make up each group, respectively.

### 4.2 Timing of Incentive Effects

Another potential concern when analyzing employment growth in "treated" (incentivized) establishments is that policymakers may have some unobservable knowledge about the establishments that leads them to grant an incentive in the first place. This introduces the possibility of endogeneity between the treatment and the outcome. It is possible that establishments approach state officials at a critical time in their lifespan, when they are planning to either upgrade their plants or expand production. This would positively bias the results if those firms that received an incentive were already growing. Conversely, establishments that are part of a larger corporate structure that is retracting because of falling demand may receive an incentive in order to preserve employment in North Carolina and encourage the firm to make plant closings elsewhere. This would potentially negatively bias the results. The problem of pretreatment bias was first illustrated by Ashenfelter and Card (1985); they showed that a downward trend in earnings among job training recipients prior to training led to biased estimates of the value of training programs. To test for the presence of an "Ashenfelter dip," we estimate a modified version of our main specification with a distributed lag structure of the incentive indicator variable.

(2) $$\ln Emp_{it} = \alpha + \sum_{k=t-2}^{k=t+1} \beta_k Inctv_{ik} + \gamma_t + \tau_i$$

In Equation (2), the variable $Inctv_{it}$ is estimated for each year from two years prior ($k = t - 2$) to the actual year incentive through a one-year lag ($t + 1$). We use only one year postincentive since our data only go through 2008 and we would be forced to drop all incentives granted in 2006. In addition, we are more concerned with checking for a pretreatment bias than for the timing of potential growth after the incentive is made. In fact, since the one-year lag is coded "1" for all subsequent years, the value of $\beta_{t+1}$ can be interpreted as the long-term impact on employment.

### 4.3 Recruitments

As indicated above, we cannot analyze the recruitment incentives with the same panel regression models since we do not have any pretreatment observations on the outcome variable. To overcome this we adopt a different research design that simply compares the differential growth rate in employment between incentivized and nonincentivized establishments. We collapsed the panel database used for the retention analysis and calculated the net and percentage change in employment change over the lifespan of all establishments in North Carolina. We then compared the mean growth rate across the treatment and control groups and analogously broke out the results for regional targets and mediated sectors.

After collapsing the database and calculating growth rates at the establishment level, we needed an appropriate control group to conduct a simple difference of means test on the growth rates of incentivized firms and nonincentivized ones. Because year and establishment fixed effects cannot be used in this context, a more nuanced estimate of which establishments would serve as good controls was necessary. To do this we used a Mahalanobis nearest-neighbor matching technique that finds candidate control observations for each treated establishment based on its values on a set of observable covariates. Similar to propensity score matching, this technique uses the values of the nearest-neighbor index to weight the outcome variable of the controls. The specific matching criteria are the three-digit SIC Code, the start-up year, a dummy variable indicating whether the establishment moved from out of state, whether it was a branch plant or a subsidiary of a larger corporation, and the number of related establishments within the firm. Since we are matching on the year that the establishment appeared in the NETS, this effectively matches a firm that received an incentive in, say, 2003 with an establishment in a similar industry that also started in that year. Although these results are not directly comparable

with the retention analysis, they use the same difference-in-differences logic described above. We discuss the findings of this empirical analysis in Section Five, below.

## 5. EMPIRICAL RESULTS

Overall, this analysis indicates that firms that received either form of state-level incentive experienced moderate and statistically significant positive employment growth in the years following the deal. However, this result may not be surprising, given that 1) the incentive dollars may positively influence the profitability of subsidized firms and 2) North Carolina's historical cautiousness in using incentives may result in less risky use of incentives statewide. More importantly for the main hypothesis—that long-term state-led planning and mediation positively influence incentive effectiveness—we find convincing evidence that mediation does indeed matter for the primary outcome that economic developers attempt to influence, namely jobs. Below, we discuss the findings in detail for retention and recruitment deals.

### 5.1 Retention Impacts

Table 2 presents the results of the difference-in-differences regression analysis for retentions. Column 1 lists the impact of incentives on all retention deals made during the study period relative to nonincentivized establishments in the set of three-digit peer SIC codes in North Carolina. The point estimate ($\beta$) on the natural log of employment of 0.199 is significant at the 0.01 level and indicates that establishments that received a retention grant grew approximately 20 percent faster after the incentive than nonincentivized companies. In columns 2 through 5 we explore the impact of incentives across industries that were identified by the state's regional partnerships as strategic targets.

**Table 2 Employment Impacts for Retention Incentive Grants in North Carolina**

| | All | Regional targets | | | | Mediated sectors | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Incentive estimate ($\beta_1$) | 0.199*** | 0.147*** | 0.109** | 0.334*** | 0.043 | 0.279*** | 0.081** |
| (on ln employment) | (0.027) | (0.043) | (0.049) | (0.072) | (0.054) | (0.058) | (0.034) |
| Sample restrictions | | | | | | | |
| Treatment | All retentions | Regional targets | Nontargets | Aspirational targets | Existing strengths (LQ > 1.1) | Mediated sectors | Nonmediated sectors |
| Control | All peer SICs | Target peer SICs | Nontarget peer SICs | Target peer SICs | Target peer SICs | Mediated peer SICs | Nonmediated peer SICs |
| *N* | 939,024 | 444,826 | 493,797 | 444,451 | 444,646 | 174,784 | 764,058 |
| Adj. *R*-squared | 0.8743 | 0.8728 | 0.8645 | 0.8583 | 0.8587 | 0.8824 | 0.8546 |

NOTE: All models include year fixed effects and establishment fixed effects. Robust standard errors in parentheses below estimate. Incentive estimate refers to the coefficient $\beta$ on the incentive dummy variable. Dependent variable is the natural log of employment. ** significant at the 0.05 level; *** significant at the 0.01 level.

Overall, deals made in industries that were regional targets performed slightly better than nontargeted deals (0.147 vs. 0.109). Each point estimate is significant, although the difference between these two estimates is not. When we break down the targeted incentives in more detail we find that deals made in industries that we consider "aspirational" for the respective region—meaning that that particular industry did not have a location quotient greater than 1.1 at the county level—were significantly stronger than those made in industries that were already strong export industries. Although we do not have a strong sense of how state and local policymakers are using and implementing the targeting planning process, we interpret this finding as being broadly supportive of the role of using incentives within a strategic process of industrial development. The reason why incentivized establishments in aspirational target industries showed significantly higher employment growth could be that state planners are successfully building out growth clusters in the region (i.e., they are helping grow the industries that support or have strong linkages with existing export sectors) or that strategic analysis allows the state to be more successful at reaching high-growth establishments. Since these incentives are for

establishments that started in North Carolina—presumably without a direct subsidy—this result can also be interpreted as a focus on supporting endogenous growth in emerging industries.

More interestingly, our findings on the impact of mediation on incentive outcomes (columns 6 and 7) show strong support for the arguments outlined in Section Two. Specifically, we find that incentives made in the mediated sectors of life sciences/biomanufacturing and textiles/nonwovens were associated with 28 percent faster employment growth at the establishment level compared to nonincentivized establishments in the same industry sectors. As a reminder, this is not simply a result of these sectors performing better overall, since the control observations come from the same set of industries. Incentives made in all other (nonmediated) sectors did not perform nearly as well, having a point estimate of 0.08. We suggest that the process of mediation itself enables the system of actors that participate in the incentive negotiation process to sift through the universe of potential firms to consider a range of benefits they will receive from engaging with the assets of the region and the state. This includes sector-based workforce development supports that can expedite hiring and expansion decisions, thus directly affecting employment outcomes.

### 5.2 Robustness Check for Pretreatment Bias

To test for the presence of a pretreatment trend in employment growth, we re-estimated all of our models using Equation (2). These results are presented in Table 3, below. Note that although each model includes two lead terms and one lag ($t-2$ through $t+1$), we only report the coefficient for $\beta_{t+1}$, which is interpreted as the impact on employment for one year after the incentive took effect and all subsequent years. In this analysis, the overall magnitude and pattern of the findings remains the same, which is reassuring in terms of concerns over a pretreatment bias.

**Table 3 Employment Impacts for Retention Incentive Grants in North Carolina, Distributed Lag Structure**

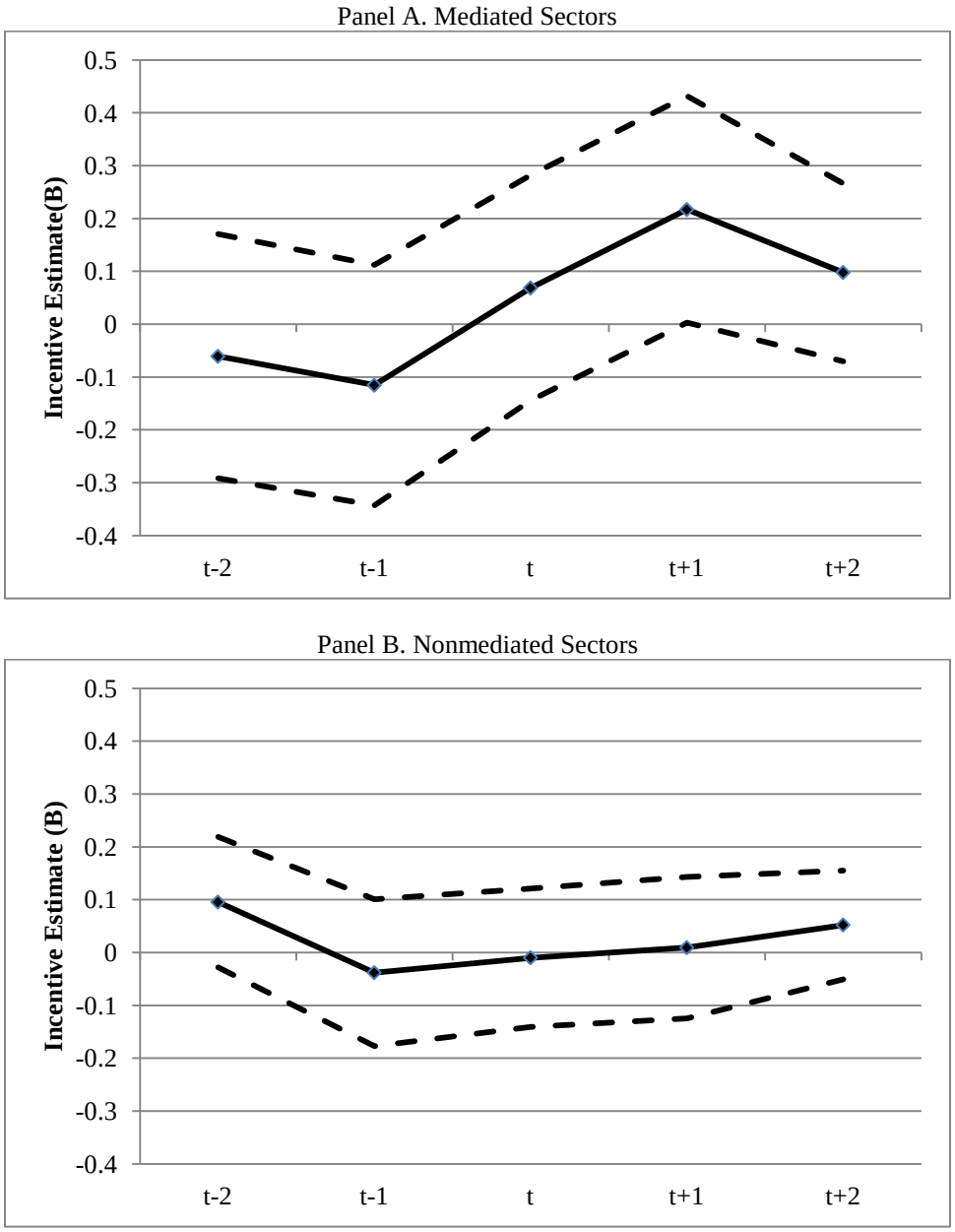
| | All | Regional targets | | | | Mediated sectors | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Incentive estimate ($\beta_{t+1}$) | 0.157*** | 0.154*** | 0.113 | 0.267*** | 0.095 | 0.289*** | 0.063 |
| | (0.048) | (0.074) | (0.091) | (0.129) | (0.090) | (0.101) | (0.060) |
| Sample restrictions | | | | | | | |
| Treatment | All retentions | Regional targets | Nontargets | Aspirational targets | Existing strengths (LQ > 1.1) | Mediated sectors | Nonmediated sectors |
| Control | All peer SICs | Target peer SICs | Nontarget peer SICs | Target peer SICs | Target peer SICs | Mediated peer SICs | Nonmediated peer SICs |
| *N* | 939,024 | 444,826 | 493,797 | 444,451 | 444,646 | 174,784 | 764,058 |
| Adj. *R*-squared | 0.8743 | 0.8728 | 0.8645 | 0.8583 | 0.8587 | 0.8824 | 0.8546 |

NOTE: All models include year fixed effects and establishment fixed effects. Robust standard errors in parentheses below estimate. "Incentive estimate" refers to the coefficient $\beta_{t+1}$ on the incentive dummy variable. Regression also includes variables for the incentive dummy in $t-2$, $t-1$, and $t$. Coefficients on other lead and lag terms are not reported here for brevity's sake. Dependent variable is the natural log of employment. *** significant at the 0.01 level.

For all retention deals, there was a statistically significant positive impact of 0.157, or approximately 16 percent faster employment growth. Incentive deals made in regional targets and mediated sectors also outperformed nontargeted and nonmediated sectors, respectively. However, to examine the issue of pretrends in more detail, we plot the values of each lead and lag coefficient (this time with two years pre/post) for mediated and nonmediated sectors.

As shown in Figure 1, above, the timing of the positive employment growth impact for incentives in mediated sectors is closely associated with the timing of the incentive deal, with point estimates close to zero and insignificant before the deal and positive afterwards (see Panel A). However, for nonmediated incentives (Panel B) the pattern appears relatively flat. We take this as evidence of a robust causal influence of the impact of incentives on employment growth for mediated sectors.

**Figure 1 Time Path of Retention Incentive Impact on the Natural Log of Employment in North Carolina Establishments in Mediated and Nonmediated Sectors**




NOTE: Figures plot the coefficients for the distributed lag specification of Model 2 with two leads and lags of the incentive dummy variable. All models include year and establishment fixed effects. Coefficients are plotted in the solid line, and the 90 percent confidence interval is represented by the dashed lines.

### 5.3 Recruitment Impacts

Finally, we report the findings of our analysis of recruitment deals in Table 4. Unlike the panel regression models described above, the figures reported in this table are simple difference-of-means tests comparing the net employment change over the lifetime of the establishment in North Carolina. Like the retention analysis, we repeat the test for each category of incentive. Column 3 is the key column for interpreting the results, since it lists the difference in employment growth between the treatment (i.e., incentivized establishments) and controls. This is also referred to as the *local average treatment effect* (LATE) (Imbens and Angrist 1994). The number of treatment cases is listed in parentheses in each row.

**Table 4 Employment Change in Recruited Establishments and Control Groups in North Carolina**

| | (1) Treatment | (2) Controls | (1) – (2) Difference | *t*-stat |
|---|---|---|---|---|
| All recruitments (*N* = 119) | 13.43 | 1.91 | 11.53 | 2.33 |
| Regional targets (*N* = 49) | 19.92 | 2.47 | 17.45 | 2.37 |
| Nontargets (*N* = 69) | 8.83 | 3.38 | 5.45 | 0.83 |
| Mediated sectors (*N* = 17) | 25.00 | –1.82 | 26.82 | 1.81 |
| Nonmediated sectors (*N* = 101) | 11.49 | 3.52 | 7.96 | 1.54 |

NOTE: Outcome variable is the net employment change since establishment start. Matching variables for Mahalanobis metric matching (3-digit SIC Code), First year, In-mover status, Relocated YN, Branch, Subsidiary, No. of related establishments in firm.

As described earlier, the control observations for each are selected based on a Mahalanobis nearest-neighbor metric matching system. This system uses the observed characteristics in the matching variables to choose a set of nontreated observations for each treatment case. For example, for a given recruitment deal that occurred in 2002 the matching program will find control observations that also started in NETS in that year and had the same (or a very similar) three-digit SIC code and similar corporate structure characteristics. Overall,

the same general pattern of impacts is observed for recruitment deals as for retentions: the overall impact is positive and statistically significant.

Specifically, establishments that received a recruitment incentive added 11.53 more jobs over their lifespan relative to similar establishments in the state. Note that while this figure seems small compared to some of the job announcements made at the time of incentive, this figure is the difference in net jobs created compared to the first year the establishment appears in the NETS data set. So if a plant opens in 2002 with 100 jobs and has 120 in 2008, the net job creation since start-up is 20 jobs. Regional targets seemed to be more effective at subsequent job creation compared to nontargeted deals. Recruitments made in mediated sectors had the largest differential effect compared to the control group, with a net difference of 26.8 jobs. This figure is significant at the 0.10 level, which is notable given the relatively small sample size of recruitments.

## 6. CONCLUSION AND POLICY IMPLICATIONS

This paper has presented a detailed empirical analysis to determine the employment impact of state-level incentive granting in North Carolina from 1996 to 2006. It is one of the few studies to conduct difference-in-differences tests of the effectiveness of incentives in generating net new job creation. Relative to carefully selected control groups, both retention and recruitment deals were shown to produce positive and statistically significant employment growth. Since we use two distinct research designs—for retention and recruitment deals, respectively—the results are not directly comparable on a job-for-job basis. However, in both cases we find that incentives made in sectors that were either regional targets or associated with broader industry mediation efforts at the state level outperformed those made outside such sectors.

A fundamental implication of the empirical analysis offered by this paper is that planners cannot continue to look at the issue of incentives in a narrow, positive-or-negative way. Our results indicate that what drives the positive incentive impacts in North Carolina overall is not simply the amount offered relative to other locations, but the fact that incentives are integrated into a broader institutional support system epitomized by a process we call mediation.

**NOTES**

1. In 2008, the system was collapsed to three tiers.

2. While we cannot directly estimate the universe of economic development incentives made exclusively by local government, we feel that we capture the majority of large incentive projects since 1996 in the state of North Carolina. Local governments must obtain permission for any tax expenditure or bond issue from the Local Government Commission (LGC). The LGC is a state agency that exercises fiscal oversight of local government and results in a major curtailment of risky development policies such as tax increment financing.

3. The annual reports were accessed at http://www.nccommerce.com/research-publications/incentive-reports. However, since these annual reports only contain information on incentives that were active in the given year, and since annual reports were not available for the full set of years, we use the Kenan Institute's Media Study as the universe of incentives, and we confirm the information on year of incentive through the North Carolina Department of Commerce reports.

4. While this approach is less nuanced than using the dollar level, given the lack of good-quality data on incentive dollar amounts that companies actually received, we believe it is a cleaner way to conduct the analysis. In addition, we are not interested in portraying the results as an elasticity (i.e. the percentage change in employment expected with a given percentage change in incentive dollars).

## REFERENCES


Ashenfelter, Orley, and David Card. 1985. "Using the Longitudinal Structure of Earnings to Estimate the Effect of Training Programs." *Review of Economics and Statistics* 67(4): 648–660.

Bartik, Timothy J. 2005. "Solving the Problems of Economic Development Incentives." *Growth and Change* 36(2): 139–166.

Cox, Linda J., Jonathan E. Alevy, Thomas R. Harris, Barbara Andreozzi, Joan Wright, and George "Buddy" Borden. 2009. "The Community Business Matching Model: Combining Community and Business Goals and Assets to Target Rural Economic Development." In *Targeting Regional Economic Development*, Stephan J. Goetz, Steven C. Deller, and Thomas R. Harris, eds. New York: Routledge, pp. 255–278.

Faulk, Dagney. 2002. "Do State Economic Development Incentives Create Jobs? An Analysis of State Employment Tax Credits." *National Tax Journal* 55(2): 263–280.

Feldman, Maryann P., and Nichola J. Lowe. 2011. "Restructuring for Resilience." *Innovations: Technology, Governance, Globalization* 6(1): 129–146.

Gabe, Todd M., and David S. Kraybill. 2002. "The Effect of State Economic Development Incentives on Employment Growth of Establishments." *Journal of Regional Science* 42(4): 703–730.

Goetz, Stephan J., Steven C. Deller, and Thomas R. Harris, eds. 2009. *Targeted Regional Economic Development*. New York: Routledge.

Goss, Ernest P., and Joseph M. Phillips. 1997. "The Effect of State Economic Development Agency Spending on State Income and Employment Growth." *Economic Development Quarterly* 11(1): 88–96.

Greenstone, Michael, and Enrico Moretti. 2003. "Bidding for Industrial Plants: Does Winning a 'Million Dollar Plant' Increase Welfare?" NBER Working Paper No. 9844. Cambridge, MA: National Bureau of Economic Research.

Grimsley, Wayne. 2003. *James B. Hunt: A North Carolina Progressive*. Jefferson, NC: McFarland and Company.

Hicks, Michael J., and Michael LaFaive. 2011. "The Influence of Targeted Economic Development Tax Incentives on County Economic Growth: Evidence from Michigan's MEGA Credits." *Economic Development Quarterly* 25(2): 193–205.

Imbens, Guido W., and Joshua D. Angrist. 1994. "Identification and Estimation of Local Average Treatment Effects." *Econometrica* 62(2): 467–475.

Lester, T. William. 2011. "The Impact of Living Wage Laws on Urban Economic Development Patterns and the Local Business Climate: Evidence from California Cities." *Economic Development Quarterly* 25(3): 237–254.

Link, Albert N. 1995. *A Generosity of Spirit: The Early History of the Research Triangle Park.* Research Triangle Park, NC: Research Triangle Foundation of North Carolina.

Loh, Eng Seng. 1993. "The Effects of Jobs-Targeted Development Incentive Programs." *Growth and Change 24*(3): 365–383.

Lowe, Nichola J. Forthcoming. "Beyond the Deal: Using Industrial Recruitment as a Strategic Tool for Manufacturing Development." *Economic Development Quarterly*.

Markusen, Ann, ed. 2007. *Reining in the Competition for Capital*. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Neumark, David, Junfu Zhang, and Brandon Wall. 2005. "Employment Dynamics and Business Relocation: New Evidence from the National Establishment Time Series." NBER Working Paper No. 11647. Cambridge, MA: National Bureau of Economic Research.

North Carolina Department of Commerce. 2012. *Economic Development Grant Report: A Report Given to the Joint Select Legislative Committee for Economic Development and Global Engagement Oversight of the North Carolina General Assembly*. Raleigh, NC: North Carolina Department of Commerce.

Osterman, Paul, and Rosemary Batt. 1993. "Employer-Centered Training for International Competitiveness: Lessons from State Programs." *Journal of Policy Analysis and Management* 12(3): 456–477.

Persky, Joseph, Daniel Felsenstein, and Wim Wiewel. (1997). How Do We Know That 'But for the Incentives' the Development Would Not Have Occurred?" In *Dilemmas of Urban Economic Development: Issues in Theory and Practice*, Richard D. Bingham and Robert Mier, eds. Thousand Oaks, CA: Sage, pp. 28–45.

Peters, Alan, and Peter Fisher. 2004. "The Failures of Economic Development Incentives." *Journal of the American Planning Association* 70(1): 27–37.

Rohe, William M. 2011. *The Research Triangle: From Tobacco Road to Global Prominence*. Philadelphia: University of Pennsylvania Press.

Woodward, Douglas, and Paulo Guimarães. 2009. "Porter's Cluster Strategy and Industrial Targeting." In *Targeting Regional Economic Development*, Stephan J. Goetz, Steven C. Deller, and Thomas R. Harris, eds. New York: Routledge, pp. 68–83.