LIFE SCIENCES AND BIOENGINEERING: PRIORITY AREAS FOR RESEARCH COMMERCIALIZATION

Report from the Life Sciences and Bioengineering Task Force
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Executive Summary

In Louisiana and across the nation, industry productivity in the life sciences and bioengineering is robust and poised for rapid increases in revenue and job growth. Industry in this sector, perhaps like no other, is supported by and dependent on the productivity of university-based research. This interdependence already contributes significantly to Louisiana's economy, especially when considering new revenue to the State in support of university-based research that accounts for expenditures exceeding $430 Million annually. The output of that research has tremendous commercialization potential, rich with the promise to build new revenue streams and to grow Louisiana's economy with clean, high paying jobs. The following economic indicators demonstrate the strength, vibrancy, and upward trajectory of the bioscience industry nationally and in Louisiana[1,2]:

Nationally:

- In 2012, U.S. Bioscience companies employed 1.62 million personnel across more than 73,000 individual companies.
- Over the past decade the overall bioscience industry has added 111,000 new jobs or over 7 percent of its previous employment base.
- These have wages over 80% greater than the overall private sector and growing at a faster rate.
- The economic output of the overall bioscience industry has grown at a 17% annual growth rate since 2007. This is twice the private sector average.
- The population of the US is aging. Investments in this industry will be necessary in order to maintain a high quality of life while reducing the overall cost of healthcare.
- The overall market size of biotechnology products is projected to reach $1.5 trillion by 2015 for healthcare, energy and industrial and agricultural biotechnology.

In Louisiana:

- Research, Testing and Medical Laboratories is a fast growing sector: 42.3% change from 2007 to 2012.
- The Bioscience Industry Direct-Effect Employment Multiplier is very high at 5.2.
- Bioscience Industry establishments are being created in Louisiana at twice the national average.
- Louisiana now has more than 10,000 bioscience industry jobs that span 970 business establishments.
- Louisiana has a specialized employment concentration in agricultural feedstock and chemicals with 150% of the average concentration for the nation.
- Louisiana-based agricultural industries contribute $11.8 billion to the State's economy with $4.9 billion of that originating from value-added industries.
- Louisiana's research universities are especially focused in the biosciences relative to other fields with $439 Million in bioscience academic R&D expenditures in 2012. In Louisiana, the life sciences and bioengineering represent 67% of all academic research compared with 61% for the national average.
- The state has over 400 patents issued in the biosciences since 2009, spread across a diverse set of technology areas including drugs and pharmaceuticals, biochemistry, and medical and agricultural products.

Our analyses indicate particular strength in three areas of concentration at Louisiana universities. We propose these (not ranked) as ***priority areas for research commercialization*** in Life Sciences and Bioengineering:

1. **Biotechnology**. This priority area encompasses developments that harness biological processes to develop technologies and products that improve our lives and our health. In the life sciences, such developments include breakthrough products to combat disease, reduce our environmental footprint and feed the hungry. Outstanding resources and capacity in Biotechnology are already in place in Louisiana with a concentration of talent and experience in agriculture, medicine, and specialty chemicals. We propose herein to organize and integrate our outstanding resources in the academic and industrial sectors in Louisiana towards the development of new products and services and the significant increase in new biotechnology companies in the state.

2. **Engineering of Medical Technologies and Devices**. Research in this priority area builds on the translational sciences and engineering and on workforce training to develop clinically relevant biomedical technologies and devices that lead to commercial products. These may be targeted, for example, towards improving the quality of life of our aging population, rapid cost-effective diagnostics, or a reduction in the cost of health care. Louisiana's capacity and productivity in this area is rapidly growing as evidenced by recently licensed products based on university intellectual property. Research in this area is inherently translatable, and the path to commercialization is considerably shorter and less demanding of major capital investment than many areas of research commercialization. Of considerable note as well is the strong alignment with national priorities.

3. **Advances in Healthcare and Medical Informatics**. Research in this area builds on established strengths at Louisiana universities including Medicine and Public Health, Bioinformatics, Genetics, Materials Engineering and Microbiology. Louisiana universities have a long history of research commercialization in this area, and it encompasses by far the largest area of externally sponsored research in the state. Focus areas of greatest capacity include drug development, innovation in diagnosis, treatment and prevention, epidemiology and public health. Investment in this area leverages strength in clinical trials capacity at Pennington Biomedical Research Center and elsewhere around the state, increasing collaborations across the state for multi-center clinical trials. It provides opportunity for research and clinical collaboration with industry, and is strongly aligned with national priorities to manage healthcare costs.

It is envisioned that rapid growth in these priority areas in Louisiana will increase the state's revenue base, create new jobs in significant numbers, and employ the state's workforce trained by Louisiana's universities. We describe herein a summary of the major strengths and opportunities in each of these priority research commercialization areas. We offer an investment strategy designed to optimize their development.

References

1. Batelle/BIO State Biosciences Jobs, Investments and Innovation, 2014
2. BioDistrict New Orleans Economic Impact Study, October 2010

PRIORITY AREAS FOR RESEARCH COMMERCIALIZATION IN THE LIFE SCIENCES AND BIOENGINEERING

Priority Area 1: BIOTECHNOLOGY

Rationale:

Biotechnology efforts in Louisiana are relatively mature, already productive, but need to be organized to reach full potential. The focus area in Biotechnology will organize outstanding existing resources within both the academic and industrial sectors in Louisiana towards the development of additional biotechnological products and services and the significant increase in new biotechnology companies starting up in Louisiana, or attracted to Louisiana from other states. It is envisioned that enhancement of these biotechnology sectors will lead to rapid growth of biotechnology industry in Louisiana employing a significant portion of the state's workforce trained by Louisiana's universities. Improved organization of state resources and state targeted investments will result in increasing annual employment with the potential to match or exceed national employment growth trends (currently at 7 per cent annually**).**

1) The US-based Biotechnology industry is economically robust and poised for rapid increases in employment levels

Definition: Biotechnology (biotech) describes any technological process that harnesses cellular and bio-molecular processes to develop technologies and products that help improve our lives and the health of our planet. Modern biotechnology provides breakthrough products and technologies to combat debilitating and rare diseases, reduce our environmental footprint, feed the hungry, use less and cleaner energy, and have safer, cleaner and more efficient industrial manufacturing processes (*Biotechnology: Industry Analysis, Key Players & Future Trends. http://www.datafox.co/blog/biotechnology-industry-analysis-key-players-future-trends/.*

Nationally:

- In 2012, US. Bioscience companies employed 1.62 million personnel across more than 73,000 individual companies.
- Over the past decade the industry has added nearly 111,000 new, high paying jobs, or over 7.4 percent of its previous employment base.
- Economic output of the bioscience industry had a 17 percent growth since 2007, twice the national private sector nominal output growth.
- The bioscience industry creates new high-wage, family sustaining jobs with average wages 80 percent greater than the overall private sector and growing at a faster rate.
- The overall market size of biotechnology products is projected to reach $1.5 trillion by 2015 for healthcare, energy and industrial and agricultural biotechnology: Specifically: 1) Healthcare: Biotechnology products represented 21% of the total $714bn global market for prescription drugs in 2012, equating to $150bn of sales. The size of the prescription drugs market is expected to grow at a Compound Annual Growth Rate (CAGR) of 3.8% to reach $895bn in 2018, and the biotechnology industry's share of this is expected to grow to 25%, equivalent to $224bn. This represents a CAGR of 6.9% for the biotech market, higher than the growth of aggregate pharmaceutical industry because biotechnology products have a less aggressive rate of sales erosion from generic drugs (*Evaluate Pharma 'World Preview 2013, Outlook to 2018'*). 2) Energy & Industrial: An increasing number of chemicals and materials, like base chemicals, polymers, industrial catalysts, enzymes and detergents are produced using biotechnology. In 2010, the sales

of industrial chemicals created using biotechnology in at least one step of the production process equaled $130 bn globally, and this is expected to increase to $320 bn by 2015 (from *Festel, G., Detzel, C. and Maas, R. 2012 'Industrial biotechnology – Markets and industry structure', Journal of Commercial Biotechnology, Volume 18, No. 1*). 3) Agriculture: The size of the agricultural biotechnology market is expected to grow to the value of $12bn by 2015 (*Transparency Market Research 'Agricultural Biotechnology Market, 2012-2018').*

In Louisiana:

- Louisiana has more than 10,000 bioscience industry jobs that span 970 business establishments. Renaissance RX, a company initiated in Louisiana as a biomedical start-up, recently announced a 425-job expansion in New Orleans including completion of an $8 Million headquarters expansion to support growth of pharmacogenetic testing.
- Louisiana has a specialized employment concentration in agricultural feedstock and chemicals where the state has one and a half times the average concentration for the nation.
- $11.8 billion of economic contribution from Louisiana-based agricultural industries, with $4.9 billion of that originating from value-added industries.
- Louisiana's research universities are especially focused in the biosciences relative to other fields with their $439 million in bioscience academic R&D in 2012 accounting for 67 per cent of all academic research compared with 61 percent for the national average.
- The state has over 400 patents issued in the biosciences since 2009, spread across a diverse set of technology areas including drugs and pharmaceuticals, biochemistry, and medical and agricultural products.

(Batelle/BIO State Biosciences Jobs, Investments and Innovation, 2014).

2) **Biotechnology is already significantly contributing to Louisiana's economy based on current academic and industrial activities.** Improved organization of state resources and targeted investments will result in increasing annual employment with the potential to match or exceed national employment growth trends (currently at 7 per cent annually**).**

- Biotechnology builds on significant Louisiana-based academic and industrial strengths especially in agricultural and biomedical biotechnology and specialty chemicals for food, energy and agricultural uses.
- The total amount of patent-associated royalties and licensing income from university-based biotechnology discoveries exceeds $20 million annually. Most of the beneficiaries are companies situated outside of Louisiana.
- The state has organized bioincubators that facilitate the creation of biotechnology start-up companies. These include:
- Intertech. A division of the Biomedical Research Foundation of Northwest Louisiana. This incubator has over 60,000 square feet of space and houses more than 20 companies working in the life science, pharmaceutical and other sectors. InterTech personnel provide recruitment, planning, financial and market strategies and other incubator services.
- New Orleans BioInnovation Center (NOBIC). This incubator provides comprehensive services for new biotech start-up companies and has over 60,000 square feet of available space currently housing over 20 bioscience-based companies. The facility is housed in the burgeoning medical district of downtown

New Orleans where more than $3 billion have been invested for new hospital and biomedical research construction.

- The LSU Emerging Technology Center (LAETC). This incubator center provided comprehensive services for biotech companies and has over 60,000 square feet of space currently housing 10 biotech companies. LAETC is operated by the LSU Research and Technology Foundation that has the following goals: a) assist Louisiana universities with technology transfer; b) assist start-up technology with access to capital; 3) help provide infrastructure for commercial development of university research.
- Louisiana Tech University Technology Incubator (LTTI). This incubator has approximately 20,000 square feet of space and provides incubator services for technology start-up companies including biotech companies.
- Louisiana Technology Park (LTP), located in downtown Baton Rouge, has over 60,000 square feet of space for high technology start-ups including biotech companies. Currently it houses over 20 technology companies.
- The Louisiana Business and Technology Center (LBTC) is located within the LSU Innovation Park located a few miles south of the LSU main campus in Baton Rouge, LA. LBTC provides comprehensive services for high-tech start-up companies and has more than 50,000 square feet of space currently housing 25 high tech companies. Other major tenants within the LSU Innovation park include: a) The Louisiana Army National Guard and Disaster Response Center – Provides trained and ready Soldiers, Airmen, and units for deployment in support of national military objectives, across 50 acres in a 220,000 square foot facility. b) Louisiana Business Emergency Operations Center of the Stephenson Disaster Management Institute – Works to enhance the state's emergency management efforts by supporting the continuity of business and industry during and after a crisis or emergency. c) The National Center for Biomedical Research & Training— Provides high-quality training to emergency responders throughout the United States to help them prevent, prepare for, respond to and recover from the acts of domestic and international terrorism, weapons of mass destruction, and high-consequence events. d) The Emerge Center— Founded by the Baton Rouge Speech and Hearing foundation, the Emerge Center's 26,000 square foot facility, offers clinically effective therapies to children and adults with communication difficulties and Autism. e) Carver Scientific Inc. – Develops innovative materials, processes, and technologies that bring transformative change to the way electricity is generated, managed, and stored.

Major Strengths

- $11.8 billion of economic contribution from Louisiana-based agricultural industries, with $4.9 billion of that originating from value-added industries.
- $439 Million in Bioscience R&D expenditures in Louisiana-based institutions (2012)
- $133 million of NIH competitive funding obtained by Louisiana universities (2013).
- $150 million over five years in NIH-funded centers that manage state-of-the-art biotechnology core facilities including animal resources.
- 250,000 sq ft of space is available for product development around the state, but organization and uniform coordination is needed.

- Three non-human primate animal facilities (Tulane National Primate Research Center, Covington, LA; New Iberia Research Center, New Iberia, LA; Chimp Haven-National Chimpanzee Sanctuary, Shreveport, LA).
- Six incubators for start-up companies strategically located throughout Louisiana.
- Availability of venture capital provided by Louisiana and US-based entities including:
  - The New Orleans Startup Fund (NOSF) is a non-profit 501(c)(3) evergreen seed fund established by business and financial leaders in the Greater New Orleans area to accelerate the growth of early-stage, innovative businesses into venture-ready companies.
  - Advantage Capital Partners is a group of venture capital partnerships with offices across the United States. The group offers equity and debt capital as well as value-added counsel.
  - BizCapital primarily makes loans for small to medium sized companies. The company funds its own loans and specializes in Asset Acquisitions, Start-Ups, Working Capital, and Business Expansion.
  - BVM Capital is a venture capital firm that provides equity capital to starting businesses as well as businesses looking to expand and that are technology-based or that have unique products for a large market.
  - Louisiana Angel Network is a non-profit corporation that promotes entrepreneurial growth by bringing together a network of accredited investors interested in potentially making private equity, early-stage investments into Louisiana-based entrepreneurial businesses.
  - Louisiana Fund I is an early stage venture capital fund focused on the identification of investment opportunities emanating from research universities and other organizations in the State of Louisiana.
  - Source Capital Corporation provides venture capital for seed, start-up, first stage, second stage, acquisitions, business sales, debt placement, and government-guaranteed loans.
  - First Louisiana Business and Industrial Development Corporation (First BIDCO)- has certified lender status from the SBA to originate SBA 7(a) guaranteed loans.
  - Stonehenge Capital Corporation is a Venture capital subsidiary of Chase Bank. It provides capital for expansions, later stage, mezzanine, leveraged buyouts, and acquisitions.
  - Capital One Southcoast, Inc. is a New Orleans-based regional investment bank. The firm's primary lines of business are equity research, debt and equity sales and trading, and corporate finance.
- Over $20 million annually of income from royalties and licensing bioscience products to industry.

Key Prospects for Development: *The missing element in Louisiana is lack of organization of available biotechnology funding and resources.*

- Promote the creation of a Louisiana Biotechnology Center (LBC) similar to the North Carolina Biotechnology Center (*http://www.ncbiotech.org*). LBC will work to connect company and university researchers; funders and start-up companies; job seekers and job providers. In a similar manner to North Carolina, LBC should be a private, non-profit funded by the state and private sources to grow biotech industry in Louisiana. LBC should enlist individual campus resources in a consortium arrangement including biotech incubators and core support facilities.

- LBC will function to connect existing academic centers and resources and streamline statewide funding mechanisms that support state-wide biotechnology research and bioincubators under the LBC oversight.
- Similar to North Carolina, LBC will recognize and fund Centers of Innovation (COI) The individual COI initiatives will focus on accelerating the growth of targeted industry sectors by assisting academic and industry partners to overcome their commercialization obstacles.
- Influence the development of interdisciplinary training in biotechnology within academic institutions through LBC-directed funding of specialized courses with emphasis in business development/management, entrepreneurship, bioinformatics, and biotechnology basics.

Investment & Development Strategy

- Create and support the Louisiana Biotechnology Center (LBC) to encompass all state-funded and spearhead biotechnological activities. Allow LBC to administer and coordinate all biotechnology/life sciences related research and development programs of the state.
- LBC should be a full member of the Biotechnology Industry Organization (BIO).
- Create through LBC, training mechanism for submission of competitive SBIR/STTR grants to federal agencies
- Provide through LBC matching funds for SBIR/STTR.
- Provide through LBC a “market place” to match biotechnology companies with venture capital and other types of investing capital including crowd investing.
- Organize through LBC, GMP production facilities in Louisiana for processing of value added specialty chemicals and biotechnology products produced by Louisiana universities.
- Provide through LBC a mechanism for the recruitment of out-of-state biotechnology companies. Ideally, LBC will work with the Department of Louisiana Economic Development (LED) and individual universities to recruit companies that have been successful in obtaining SBIR phase I/II funding, as well as mid-size companies that may desire to relocate certain aspects of their work in Louisiana.

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Priority Area 2: ENGINEERING OF MEDICAL TECHNOLOGY AND DEVICES

Rationale:

The focus area in Engineering of Medical Technology and Devices will enhance the development of translational sciences and engineering and workforce creation to improve Louisiana universities' abilities to develop clinically relevant biomedical technologies and devices leading to commercial products. These may be targeted towards improving the quality of life of our aging population, rapid cost-effective diagnostics, and a reduction in the cost of healthcare.

Louisiana already has many of the resources necessary to improve the state's economic growth and job creation through a focus on Engineering of Medical Technology and Devices. For example:

- Engineering of Medical Technology and Devices builds on established strengths in foundational disciplines at Louisiana universities, including Medicine, Biomedical Engineering, Materials Engineering, Genetics and Genomics, Molecular Biology, and others.
- Engineering of Medical Technology and Devices is inherently multidisciplinary, as exemplified by the recent engagement of faculty in Louisiana's Schools of Medicine, Sciences, Engineering, Law and Business toward common goals. The state's capacity and productivity in this area is rapidly growing as is evident by recently licensed products based on university intellectual property.
- Biomedical Technology and Devices aligns with national priorities, as is evident by funding from federal agencies targeted in this area. Federal and/or state funding mechanisms include:
    - NSF: I-Corps
    - NIH: I-Corps
    - SBIR & STTR
    - Board of Regents: Opt-In, Industrial Ties Research Support
- NIH funding to Louisiana for the Biosciences is in the IVth quintile, with NIH funding per capita equaling $29 in Louisiana *vs.* an average of $70 nationally. This indicates a good opportunity for growth.
- Research in the area of medical technologies and devices is inherently translatable, and the path to commercialization is considerably shorter and less demanding of major capital investment than other areas of biotechnology. US Bioscience venture capital investments in Medical Therapeutics, Medical/Health-Products and Diagnostics were approximately $20B between 2009-2013[1].
- Louisiana is the home of well-established centers that can facilitate the development and evaluation of medical technology and devices through the integration of basic and applied research conducted at our universities. These include 1) Tulane's National Primate Research Center, which conducts basic and applied biomedical research on human health problems using nonhuman primate models, 2) the Louisiana Cancer Research Consortium, currently pursuing a National Cancer Institute (NCI) designation, 3) LSU Health Sciences Center – New Orleans' Neuroscience Center of Excellence that is investigating the causes and treatments of many neurodegenerative diseases

[1] Batelle analysis of Thompson Reuters Thomson ONE database

affecting our aging population, and 4) LSU's Pennington Biomedical Research Center that investigates the triggers of chronic diseases that are important to our aging population. In addition, the New Orleans Bioinnovation Center (NOBIC) is a model of a successful non-profit technology business incubator that fosters entrepreneurship and job creation. A start-up company from NOBIC, Renaissance RX, recently announced a 425-job expansion in New Orleans including completion of an $8 Million headquarters expansion to support growth of pharmacogenetic testing.

Major Strengths

- $7.8 Million in competitive federal funding from NIH and NSF to Louisiana universities directly related to the development of medical technologies and devices.
- Well established academic programs:
    - Biomedical Engineering Programs at LA Tech, Tulane University
    - The Department of Biological & Agricultural Engineering at LSU with research foci in Tissue Engineering & Regenerative Medicine, Cellular & Molecular Engineering and Nanoparticle Targeted Delivery
    - Center for Biomedical Engineering and Rehabilitation Science (CBERS) at LA Tech
    - The NSF-funded Interdisciplinary PhD Program at Tulane University
    - Tulane Integrative Engineering for Health and Medicine (TIEHM)
- The New Orleans BioInnovation Center (NOBIC) has already made a significant positive impact on Biomedical Technology and Device development and commercialization. To date NOBIC has supported[2]
    - Over 115 technology innovators
    - The creation of more than 200 high-wage jobs
    - Clients who have raised more than $27 million in funding
    - Provided more than $1.65 million in low-interest loans to 10 growing businesses
    - The launch of 14 new products
    - 58 public workshops for over 1,000 attendees
- Federally and foundation funded education and workforce training programs already in place.
    - NSF IGERT award at Tulane University supports training for doctoral candidates in Washington, DC at the U.S. Food and Drug Administration with the specific goals of building capacity, creating jobs and funding opportunities around biotechnology-based start-ups.
    - New support by VentureWell (Formerly National Collegiate Inventors and Innovators Alliance) to create a Tulane University Biomedical Engineering Innovation and Entrepreneurship Certificate Program.
    - NIH COBRE award to the Center on Aging. PI: Michal Jazwinski, Tulane University. In addition to the Interdisciplinary PhD in Aging, this provides training and research opportunities for students and faculty to develop biomedical technology and devices targeted towards the specific needs of our aging population.
    - In partnership with Tulane, LSU, their medical centers and 8 other research universities around the nation, Xavier has been awarded a $19.6M NIH BUILD grant to increase the number of African American Ph.Ds in the life sciences.

[2] http://www.neworleansbio.com/impact/

  - Louisiana Workforce Commission-recognized primary training, certification, and job assistance available through LA Tech's Continuing Education and Distance Learning Program and the Global Campus.
- Recently licensed products from Louisiana universities:
  - Steerable oximetric catheter – treatment of cardiovascular disease
  - InfaClip – umbilical cord cutter obstetric device
  - PerfFix - tympanic membrane technology
  - SpheriCal – calibrates bacterial diagnostic devices
- Major hospital development, including clinical trials capacity in New Orleans.
- State-wide high performance computing facilities will improve the design and analysis of biomedical technologies. Existing resources include the NSF-funded Center for Visual and Decision Informatics at ULL, the Center for Computation and Technology at LSU, the new high performance computing facilities at Tulane (Cypress), and the Louisiana Optical Network Initiative (LONI).

Key Prospects for Development:

- Reconstitute statewide Council of Technology Transfer Directors
- Add research capabilities and available technologies to AUTM's searchable database.
- Develop regional proof-of-concept interdisciplinary technology and entrepreneurial development support. This would build upon existing initiatives and would provide the necessary preliminary results for the creation of a state-wide Engineering Research Center (ERC).
  - Expand the translational research approaches initiated by the Interdisciplinary PhD program in Bioinnovation at Tulane University. This could foster collaboration between the biomedical engineering departments at LA Tech, Tulane University and LSU. Use this as a model for developing translational research that spans disciplines and brings together industry, academia and government entities.
  - Develop NSF I-CORPS sites that reinforce collaboration between biomedical engineering, health sciences and technology transfer. These projects could foster the translation of funded research out of the laboratories and into the marketplace and could lead to the commercialization of promising ideas emerging from the classroom.
- Expand the critical mass of outstanding leaders in biomedical research through targeted faculty recruitments into endowed chairs and professorships.
- Create an environment to increase the number of faculty and students who study with us and remain in Louisiana.
- Expand academic liaisons between Information Technology and research groups in science and medicine to assist faculty researchers with computational and informatics applications.
- Energize STTR/SBIR proposal submissions through support for project development.
- Expand wet lab incubator space around the state.

Investment & Development Strategy

- Create and support a Prototyping Center for development of medical devices. The Center will require expertise in:
  - Device design and development
  - FDA & regulatory affairs
  - Biomaterials

  - Trial design
  - Manufacturing and Production

- Expand research investment to build faculty capacity and productivity.
  - Increase availability of Opt-In and similar grants
  - Eminent Scholar Chairs to be cross-appointed at collaborating universities

- Replicate state-wide and expand upon the programs and goals of the current NSF IGERT program at Tulane University. The program supports training for doctoral candidates at the FDA with the specific goals of building capacity, creating jobs and funding opportunities around biotechnology-based start-ups.

- Support and build business incubation capacity in the state. Support for current Bioinnovation Centers must be continued and expanded. Graduation space is needed for new companies as they outgrow Bioinnovation Center capacity.

- Technology transfer investment: Prototyping center will lead to faster development and approval of devices. Capacity at the state's universities to patent, license and commercialize must keep up.

- Work force development: Expanded expertise in device development will build sustainable enterprises, create jobs and offer educational tracks for new workers; prototyping center and increased availability of expertise and capital will encourage these jobs to stay in Louisiana.

- Build an enabling infrastructure. Establish statewide center for enabling technologies, *e.g.,* 3-D printing. Encourage cross-utilization across Louisiana's universities for major resources that could be shared. Increase and support additional wet lab incubation space.

- The State of Louisiana should invest and partner with academic institutions, industry, state and federal government to develop an NSF Engineering Research Center (ERC)[3]. This partnership would link industry, academia and government towards the development and commercialization of innovative biomedical technology and devices.

[3] http://erc-assoc.org

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Priority Area 3: ADVANCEMENTS IN HEALTHCARE AND MEDICAL INFORMATICS

Rationale:

Focus areas in Advancements in Healthcare and Medical Informatics at Louisiana universities include drug development, innovation in diagnosis, treatment and prevention, epidemiology and public health. The rationale for prioritizing this area includes the following points:

- Work in this area builds on established strengths in foundational disciplines at Louisiana universities, including Medicine and Public Health, Computer Science, Bioinformatics, Genetics and Genomics, Materials Engineering, Molecular Biology, Microbiology.
- It encompasses the largest area of externally sponsored research support at Louisiana universities.
- It leverages strength in clinical trials capacity at Pennington Biomedical Research Center and elsewhere around the state, increasing collaborations across the state for multi-center clinical trials.
- It is inherently multidisciplinary because research in this area brings together diverse areas of biomedical research and information technology.
- Emphasis on medical informatics leverages high performance computing capacity around the state.
- It provides opportunity for research and clinical collaboration with industry.
- The emerging area of "Companion Diagnostics" is a good match for faculty interest and capacity at Louisiana universities, and a key area of development for the growing field of Personalized Medicine. The FDA defines "Companion Diagnostics" as technology-based *in vitro* approaches that identify patients most likely to benefit from a particular therapeutic product. This could include sophisticated genetic testing, ELISA-based diagnostics, others technology-based approaches under development at Louisiana universities.
- Infectious disease research and product development are areas of historic and current strength at Louisiana universities. Cost-effective, readily transportable diagnostics for infectious diseases have never been in greater demand in the face of emerging international epidemics and biodefense threats.
- The field is strongly aligned with national priorities to manage healthcare costs, improve efficiency and patient outcomes with patient-centered focus and leverage "big data" analytics.
- Louisiana universities have a long history of research commercialization in this area.
- Research is this area is inherently translatable with a clear path to commercialization.
- Louisiana has one of the highest mortality rates from cancer in the nation. The state also has the second highest proportion of African-Americans, a population shown to have the highest rate of most major cancers. Investment in Louisiana's R&D capacity in this area could have significant beneficial impact on healthcare costs and workforce costs to the state's economy.

Major Strengths:

- Encompasses the largest area of externally sponsored research in Louisiana as measured by R&D expenditures.

- Extensive clinical trials infrastructure, particularly including the Metabolic Inpatient Facility, Outpatient Clinics, Clinical Chemistry lab and other facilities at Pennington Biomedical Research Center, and the NIH-funded LACaTS project to coordinate clinical trials infrastructure around the state.
- $36 Million Center for Health Disparities at Xavier University, funded by National Institutes of Health.
- High performance computing, bioinformatics, and big data analytics capacity around the state, including the NSF-funded Center for Visual and Decision Informatics at ULL, the Center for Computation and Technology at LSU, the new high performance computing facilities at Tulane (Cypress), and the Louisiana Optical Network Initiative.
- The largest hospital construction project in the world, including clinical trials capacity and new Veterans Hospital, in New Orleans.
- Collaborative cancer research through the Louisiana Cancer Research Center including new, $110 Million research facility and $10 Million per year contribution to cancer research from state tax revenue.
- Research strength in Drug Discovery, for example, of medical foods and botanicals through the NIH-funded Botanical Research Center Grant at PBRC, and drug discovery for cancer therapeutics at the NIH-funded RCMI Cancer Research Center at Xavier University.
- Major research commercialization activity in infectious disease research including recently licensed diagnostics, vaccines and treatments.
- Recently licensed products of biomedical research in Louisiana universities:
    - Lanreotide – acromegaly, carcinoid tumors
    - AEZS-108 – cancer treatment
    - 4-Hydroxytamoxifen and endoxifen prodrugs
    - Targeted osmotic lysis therapy for cancer cells
    - Flufirvitide – influenza treatment
    - Mutant LT – vaccine adjuvant
    - Dengue fever vaccine
    - Programmable stem cells – rheumatoid arthritis treatment
    - Anti-polymer diagnostic
    - Lyme Disease Diagnostic for human use
    - Lyme Disease Diagnostic for veterinary use
    - Cancer Microarray Designs
    - Lassa Fever Diagnostic for human use
- Products in the development pipeline at Louisiana universities:
    - Ebola Disease Diagnostic under immediate consideration for licensing
    - Chewing gum-based drug delivery tool for timed release of drug
    - Soy-derived treatment for obesity and diabetes
    - New adhesive materials
    - Protein-binding materials for drug delivery
    - Method for microencapsulation of water soluble compounds
    - Novel ceramide analogues as treatment for chemoresistant breast cancer
    - Bisbenzamidines for treatment of human African Trypanosomiasis
    - Method of treating diabetic retinopathy
    - Hepatitis C Virus Replication inhibitors using siRNA combinations
    - Treatment for cytomegalovirus infection
    - Radiolabeled dye for the detection of sentinel lymph nodes
    - Assay to predict complications in diabetic patients

  - Pharmacoproteomic assay to determine a patient's response to a therapeutic agent
  - Diagnostic assay for traumatic brain injury
  - Diagnostic for Ataxia-telangiectasia
  - Cardiovascular disease treatments
  - THC-based therapies for neurodegenerative diseases
  - Vaccines and therapeutics for candidiasis and other fungal diseases
  - Novel materials to promote oral health
  - Material and method to prevent and treat ocular infection
  - Therapeutic oligonucleotide for the treatment of cancer
  - Boronic prodrugs for enhanced oral bioavailability
  - Anti-angiogenic and anti-metastatic drugs
  - Osteogenic compounds for osteoporosis in breast cancer patients

- Federally funded education and workforce training programs already in place.
  - NSF IGERT award at Tulane University supports training for doctoral candidates in Washington, DC at the U.S. Food and Drug Administration with the specific goals of building capacity, creating jobs and funding opportunities around biotechnology-based start-ups.
  - Significant funding from NIH (10 Centers for Biomedical Research Excellence, one Clinical Translational Center of Excellence, multiple other NIH-funded center grants). Total funding for 2013 is $133 million.
  - In partnership with Tulane, LSU, their medical centers and 8 other research universities around the nation, Xavier has been awarded a $19.6M NIH BUILD grant to increase the number of African American Ph.Ds in the life sciences.
  - Louisiana Workforce Commission-recognized primary training, certification, and job assistance available through LA Tech's Continuing Education and Distance Learning Program and the Global Campus.
  - Fenway Xperience program at LA Tech represents an apprenticeship program for software developers in collaboration with The Fenway Group, a Dallas-based IT services company.
  - BlueArx Partnership represents an apprenticeship program for students in marketing, journalism, graphic design, and technical writing in collaboration with BlueArx, Inc, a Shreveport-based digital marketing company.
  - Xavier University leads the nation in graduating African-American STEM professionals and as a primary undergraduate source of African-American PhDs. Xavier currently has $28 Million in active, federally funded grants to increase the number of minority graduates in STEM and Life Science fields.

- State-funded BioInnovation Centers promote and support bioscience start-up companies. One of these, Renaissance RX, recently announced a 425-job expansion in New Orleans including completion of an $8 Million headquarters expansion to support growth of pharmacogenetic testing.

- BioDistrict New Orleans, a designated 1,500 acre area in New Orleans created by the state to grow and attract bioscience companies. The BioDistrict has recently formed a partnership with the New Orleans Business Alliance, making the biosciences one of the highest priorities in the city for the promotion of economic development.

Key Prospects for Development:

- Coordinate and expand clinical research infrastructure, to include private sector clinical research organization (CRO) partners as needed, with the goal of testing the products of drug discovery at Louisiana universities.
- Support and develop of new research-based businesses through Louisiana's BioInnovation Centers and BioDistrict New Orleans.
- Identify industry and investment partners for research commercialization.
- Develop of public/private partnerships with corporate presence on Louisiana campuses.
- Expand academic liaisons between Information Technology and research groups in science and medicine to assist faculty researchers with computational and informatics applications.
- Support Leger resolution No 134 for a formula-based financing model for graduate/medical education and biomedical health-related research
- Support Appel Senate Bill No 337 to develop an outcome-based funding formula for postsecondary education
- Expand educational opportunities on intellectual property management, e.g., Technology Transfer and Commercialization course at LA Tech; practicum offered to Tulane Law students
- Expand the critical mass of outstanding leaders in biomedical research through targeted faculty recruitments into endowed chairs and professorships.

Investment & Development Strategy

- Increase funding for proof-of-concept studies to support SBIR/STTR applications and speed movement of product to market.
- Expand research investment to build faculty capacity and productivity.
    - Increase availability of Opt-In and similar grants
    - Eminent Scholar Chairs to be cross-appointed at collaborating universities
- Increase funding to develop and use health-related software and access to super-computing resources.
- Replicate statewide and expand the programs and goals of the current NSF-funded IGERT program at Tulane. The program supports training for doctoral candidates at the U.S. Food and Drug Administration with the specific goals of building capacity, creating jobs and funding opportunities around biotechnology-based start-ups.
- Expand and solidify clinical trials capacity around the state to secure collaboration for multi-center trials, engage multiple campuses on focused projects and facilitate product development.
- Support and build technology transfer capacity around the state. Capacity at the state's universities to patent, license and commercialize must keep up with the growing portfolio.
- Support and build business incubation capacity in the state. Support for current Bioinnovation Centers must be continued and expanded. Graduation space is needed for new companies as they outgrow Bioinnovation Center capacity.
- Incentivize the use of software (e.g., with health diagnostics and drug development) for scalable applications for industry; increase awareness of non-patent forms of IP protection for IT-related projects.

Appendix 1

Strategies for Research, Technology Transfer and Workforce Development: BIOTECHNOLOGY

I. RESEARCH

I.A. Strategic Initiatives

Short Term Initiatives:

- Research and catalogue all state funding for biotechnology.
- Research and catalogue all relevant institutional and private capabilities and resources in Louisiana.
- Organize an annual Biotechnology Conference to be held in the spring of every year in New Orleans over two days. This conference should include all aspects of state efforts in biotechnology including business development, technology transfer, education, and include both academic and industrial activities in agricultural, biochemical and biomedical sectors.

Intermediate and Long Term Initiatives:

- Provide through legislative action for the creation of the Louisiana Biotechnology Institute (LBI) as a not-for-profit entity to oversee all state-funded biotech activities in Louisiana.
- Enable LBI to organize and fund collaborative biotechnological research among researchers residing in different Louisiana institutions focused on the discovery of new biotechnological products and processes.

I.B. Existing and Prospective Strengths

- $11.8 billion (2012) of economic contribution by agricultural businesses in Louisiana.
- A high concentration of biotechnology-trained personnel especially in the Baton Rouge to New Orleans corridor, as well as in North Louisiana.
- $439 Million of R&D expenditures in biosciences by Louisiana-based universities
- Availability of raw chemicals and resources for downstream value-added processing.
- $3 Billion construction development in New Orleans for new hospitals and biomedical research including a new Cancer Center operated by the Louisiana Cancer Consortium and a new VA hospital and research center.

II. TECHNOLOGY TRANSFER AND COMMERCIALIZATION

II.A. Strategic Initiatives

Short Term Initiatives:

- Reconstitute statewide Council of Technology Transfer Directors to discuss common approaches.

- Create a Council of Biotechnology Incubator Directors to exchange information on best practices and resource sharing.
- Create a Council of Academic Administrators with appropriate responsibility and expertise to exchange ideas and facilitate collaboration.

Intermediate and Long Term Initiatives:

- Work toward development of the Louisiana Biotechnology Institute (LBI).
- Work to allow LBI to streamline state funding mechanisms and organize all available academic and industrial biotech expertise and resources to maximize economic development impact.
- Recruit major biotech companies to relocate to Louisiana.
- Provide incentives for value-added, downstream processing of raw materials produced in Louisiana.
- Inspire biotechnological entrepreneurship through curriculum changes to K – 12 and higher education institutions.

III. WORKFORCE DEVELOPMENT

III.A. Strategic Initiatives

Short Term Initiatives:

- Promote the development of entrepreneurship training for faculty, staff and students through targeted workshops and seminars co-sponsored by collaborating institutions.
- Catalog and promote the use of biotechnology core facilities and resources within academic institutions.
- Influence public opinion through the participation of biotechnology experts in local expert seminars, and participation in radio and TV shows.

Intermediate and Long Term Initiatives:

- Work to provide basic to advanced biotechnology curricula within academic institutions.
- Work to provide specialized hands-on training on biotechnological tools available within different academic and industrial institutions.
- Provide a series of expert seminar speakers for high schools to discuss the “fruits of biotechnology”.
- Create the Louisiana Biotechnology Initiative (LBI) (mid-to-long-term strategy) to streamline and effectively organize all biotechnology funding and resources in Louisiana.
- Take advantage of the EPSCoR/IDeA status of Louisiana to compete for large center grants from NSF and NIH that will significantly expand biotechnological capabilities within academic institutions.
- Seek regional alliances with other states proximal to Louisiana.
- Foster an interdisciplinary environment to connect biotechnological expertise to engineering and bioengineering expertise and interests.

III.B. Existing and Prospective Strengths

- Significant funding from NIH (10 Centers for Biomedical Research Excellence, one Clinical Translational Center of Excellence, multiple other NIH-funded center grants). Total funding for 2013 is $133 million.
- In partnership with Tulane, LSU, their medical centers and 8 other research universities around the nation, Xavier has been awarded a $19.6M NIH BUILD grant to increase the number of African American Ph.Ds in the life sciences.
- Strong agricultural sectors and productive technology transfer, especially through the LSU Agricultural Center—over $10 million of royalty and licensing fees annually

IV. KEY PARTICIPANTS

- Laura Levy, Vice President for Research, Tulane Health Sciences Center, New Orleans, LA.
- Andrew Lackner, Director, Tulane National Primate Research Center, Covington, LA.
- Prescott Deininger, Professor and Co-Director, Louisiana Cancer Consortium (Tulane), New Orleans, LA.
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- Steve Nelson, Dean, LSUHSC Medical School, New Orleans, LA.
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- Gene D'Amour, Senior Vice President for Development, Xavier University, New Orleans, LA.
- K. Gus Kousoulas, Associate Vice Chancellor and Center Director, LSU, Baton Rouge, LA.
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- Todd Stevens, CEO, Mary Bird Perkins Cancer Center, Baton Rouge, LA.
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- John Russin, Director, Louisiana Agricultural Experiment Station, Baton Rouge, LA.
- Phil Elzer, Associate Vice Chancellor, Louisiana Agricultural Center, Baton Rouge, LA.
- Sandra C. Roerig, Associate Dean for Research, Dean School of Graduate Studies, LSUHSC-Shreveport, Shreveport, LA.
- John F. George, Jr. President and CEO, Louisiana Biomedical Research Foundation, Shreveport, LA.
- Joseph F. Lovett, CEO. Louisiana Fund One. Baton Rouge, LA.

Appendix 2

Strategies for Research, Technology Transfer and Workforce Development: ENGINEERING OF MEDICAL TECHNOLOGY AND DEVICES

I. RESEARCH

I.A. Strategic Initiatives

Short Term Initiatives:

- Industry Day 2014, Sponsored by the Center for Cardiovascular Diseases and Sciences at LSU Health Sciences Center-Shreveport and the Center for Biomedical Engineering and Rehabilitation Science at LA Tech.
- Tulane University Health Sciences Research Days – university-wide colloquium that demonstrates strong interdisciplinary interactions focused on biomedical research

Intermediate and Long Term Initiatives:

- New support by VentureWell to create a Tulane University Biomedical Engineering Innovation and Entrepreneurship Certificate Program
- Increase collaborative ties with LA Tech Center for Biomedical Engineering and Rehabilitation Science (CBERS)
- Expand the translational research initiated by the Interdisciplinary PhD program in Bioinnovation at Tulane, and the biomedical engineering departments at LA Tech and Tulane.

I.B. Existing and Prospective Strengths

- Solid record of competitive federal research funding to Louisiana's university faculty, especially biomedical engineering faculty at Tulane and LA Tech
- Biomedical Engineering Programs at LA Tech, Tulane University
- LA Tech Center for Biomedical Engineering and Rehabilitation Science (CBERS)
- High performance computing, bioinformatics, and big data analytics capacity around the state, including the NSF-funded Center for Visual and Decision Informatics at ULL, the Center for Computation and Technology at LSU, new high performance computing facilities at Tulane, and the Louisiana Optical Network Initiative
- Eminent Scholar Chair in Biomedical Engineering and two endowed Chairs in Biomedical Engineering at Tulane (two currently open for recruitment)

II. TECHNOLOGY TRANSFER AND COMMERCIALIZATION

II.A. Strategic Initiatives

Short Term Initiatives:

- Reconstitute statewide Council of Technology Transfer Directors

- Expand educational opportunities on intellectual property management, e.g., Technology Transfer and Commercialization course at LA Tech; practicum offered to Tulane Law students; relevant seminars hosted by New Orleans BioInnovation Center; courses offered to LSUHSC-NO faculty and students by the Office of Technology Management
- Expand outreach and educational programs for investigator community around the state.
- A pending NSF I-CORPS Site project at Tulane reinforces collaboration between Biomedical Engineering, School of Medicine and Office of Technology Transfer. The collaboration supports the movement of funded research out of the laboratory and into the marketplace through commercialization of promising ideas that emerge from the classroom.

Intermediate and Long Term Initiatives:

- Develop regional proof-of-concept and entrepreneurial development support. This is important to build on existing initiatives in support of a state-wide, federally funded Engineering Research Center (ERC).
- Seek NIH funding via the NIH REACH Program. A proposal in progress at LA Tech for Research Evaluation and Commercialization Hub includes 20 letters of support from Louisiana legislators, medical centers, venture capitalists and economic development partners.
- Add research capabilities and available technologies to AUTM's searchable database.
- Continue and expand faculty outreach and training seminars, *e.g.,* Seminar on Material Transfer Agreements and Conflicts of Interest offered at LA Tech.
- Develop a combined MS program between the Schools of Science, Business, and Medicine at Tulane
- Advance interdisciplinary graduate programs in bioinnovation and entrepreneurship, e.g., Tulane's Interdisciplinary PhD program in Bioinnovation
- Garner state investment and partnership with universities, industry and government to develop an NSF Engineering Research Center (ERC)

II.B. Existing and Prospective Strengths

- Recently licensed products of bioengineering research in Louisiana universities:
    - Steerable oximetric catheter – treatment of cardiovascular disease
    - InfaClip – umbilical cord cutter obstetric device
    - PerfFix – tympanic membrane technology

- Products in the development pipeline at Louisiana universities:
    - Assisted technologies for persons with disabilities*, e.g*., Tulane project on wheelchair controlled by eye-tracking technology
- Leveraging Innovation for Technology Transfer ($LIFT^2$) Fund established at LSU's Office of the President – biannual awards of up to $50,000 to provide Proof-of-Concept funding to advance disclosed technologies.
- New Orleans BioInnovation Center (NOBIC) has made a significant positive impact on Biomedical Technology and Device development and commercialization. To date NOBIC has supported:
    - Over 115 technology innovators

- The creation of more than 200 high-wage jobs
- Clients who have raised more than $27 million in funding
- Provided more than $1.65 million in low-interest loans to 10 growing businesses
- The launch of 14 new products
- 58 public workshops for over 1,000 attendees

III. WORKFORCE DEVELOPMENT

III.A. Strategic Initiatives

Short Term Initiatives:

- Expand educational opportunities on intellectual property management, e.g., Technology Transfer and Commercialization course at LA Tech; practicum offered to Tulane Law students; relevant seminars hosted by New Orleans BioInnovation Center; courses offered to LSUHSC-NO faculty and students by the Office of Technology Management

Intermediate and Long Term Initiatives:

- Continue to develop existing training programs, e.g., Lean Process and Six Sigma Certification programs at LA Tech.
- Seek continued and expanded federal funding for relevant initiatives such as NIH T32 training program in Biomedical Technology and Device Development
- Seek foundation support from Coulter Foundation and others
- Garner state investment and partnership with universities, industry and government to develop an NSF Engineering Research Center (ERC).

III.B. Existing and Prospective Strengths

- NSF IGERT award to Donald Gaver, Biomedical Engineering, Tulane. This $3 Million award supports training for 26 doctoral candidates at the U.S. Food and Drug Administration (FDA) with the specific goals of building capacity, creating jobs and funding opportunities around biotechnology-based start-ups.
- NSF I-Team award to Michael Moore, Biomedical Engineering, Tulane
- Significant funding from NIH (10 Centers for Biomedical Research Excellence, one Clinical Translational Center of Excellence, multiple other NIH-funded center grants). Total funding for 2013 is $133 million.
- In partnership with Tulane, LSU, their medical centers and 8 other research universities around the nation, Xavier has been awarded a $19.6M NIH BUILD grant to increase the number of African American Ph.Ds in the life sciences.
- Louisiana Workforce Commission-recognized primary training, certification, and job assistance available through LA Tech's Continuing Education and Distance Learning Program and the Global Campus.
- New support by VentureWell to create a Tulane University Biomedical Engineering Innovation and Entrepreneurship Certificate Program
- A pending NSF I-CORPS Site project at Tulane reinforces collaboration between Biomedical Engineering, School of Medicine and Office of Technology Transfer. The collaboration supports the movement of funded research out of the

laboratory and into the marketplace through commercialization of promising ideas that emerge from the classroom.

- NIH COBRE award to the Tulane Center on Aging provides training and research opportunities to develop biomedical technology and devices targeted towards the specific needs of our aging population.
- Louisiana's increasing success with projects that lead to new treatment and prevention options will stimulate the creation of start-ups. Growing the number of start-ups will create jobs and offer workforce training in important skills.

IV. KEY PARTICIPANTS

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Biomedical Research Foundation of NW Louisiana
Directors of Technology Transfer, Intellectual Property Development and Research Commercialization at Louisiana's research universities
Louisiana's Biotechnology and Bioinnovation Incubators

Appendix 3

Strategies for Research, Technology Transfer and Workforce Development: ADVANCEMENTS IN HEALTHCARE AND MEDICAL INFORMATICS

I. RESEARCH

I.A. Strategic Initiatives

Short Term Initiatives:

- Industry Day 2014, Sponsored by the Center for Cardiovascular Diseases and Sciences at LSU Health Sciences Center-Shreveport and the Center for Biomedical Engineering and Rehabilitation Science at LA Tech.
- Drug discovery of medical foods and botanicals through the NIH-funded Botanical Research Center Grant at PBRC.
- Drug discovery for cancer therapeutics, supported by the NIH-funded RCMI Cancer Research Center at Xavier University, by the Tulane Cancer Center and the Louisiana Cancer Research Consortium.
- Continue development of diagnostics, therapeutics and preventatives for infectious diseases and chronic diseases.
- Strengthen research in health disparities through applications to NIH, CDC, HRSA.
- Respond to funding initiatives from Patient-Centered Outcomes Research Institute (PCORI).

Intermediate and Long Term Initiatives:

- Increase collaborative ties with UL Lafayette's NSF-funded Center for Visual and Decision Informatics.
- Continue efforts in drug discovery for cancer, infectious diseases and chronic diseases.
- Develop clinical research infrastructure, identify CRO partners as needed, to test products of drug discovery.
- Develop strategic plans for commercialization and long-term drug discovery and development.
- Complete tests of efficacy for products of drug discovery.
- Identify industry and investment partners for commercialization.
- Develop public/private partnerships with corporate presence on campus.
- Create a Louisiana-wide library of small molecules against which research institutions may screen identified targets.

I.B. Existing and Prospective Strengths

- Strong record of competitive federal research funding to Louisiana's university faculty. This priority area encompasses by far the largest sector of externally sponsored research in the state.
- High performance computing, bioinformatics, and big data analytics capacity around the state, including the NSF-funded Center for Visual and Decision Informatics at ULL, the Center for Computation and Technology at LSU, new high performance computing facilities at Tulane, and the Louisiana Optical Network Initiative.

- Extensive clinical trials infrastructure at PBRC including Metabolic Inpatient Facility, Outpatient Clinics, Clinical Chemistry lab.
- NIH-funded LACaTS project to coordinate clinical trials infrastructure around the state.
- Major hospital development, including clinical trials capacity, in New Orleans.
- NIH-funded Botanical Research Center at PBRC.
- NIH-funded Research Centers in Minority Institutions at Xavier University.
- Louisiana Cancer Research Center, a collaboration between Tulane University, LSUHSC-NO, Xavier University and Ochsner Health System.

II. TECHNOLOGY TRANSFER AND COMMERCIALIZATION

II.A. Strategic Initiatives

Short Term Initiatives:

- Reconstitute statewide Council of Technology Transfer Directors.
- Expand educational opportunities on intellectual property management, e.g., Technology Transfer and Commercialization course at LA Tech; practicum offered to Tulane Law students; relevant seminars hosted by New Orleans BioInnovation Center; courses offered to LSUHSC-NO faculty and students by the Office of Technology Management.
- Expand outreach and educational programs for investigator community around the state.
- Increase the use of clinical trials facilities by corporate sponsors. Explore industry consortium/membership models.
- Evaluate the feasibility of more IP-friendly industry sponsored research agreements.

Intermediate and Long Term Initiatives:

- Develop regional proof-of-concept and entrepreneurial development support.
- Seek federal funding for drug development and related initiatives.
- Increase the use of clinical trials facilities by corporate sponsors. Explore industry consortium/membership models.
- Increase the use of non-human primate facilities at Tulane National Primate Research Center and New Iberia Research Center for clinical testing by corporate interests.

II.B. Existing and Prospective Strengths

- Recently licensed products of biomedical research in Louisiana universities:
    - Lanreotide - treatment for acromegaly, carcinoid tumors
    - AEZS-108 – cancer treatment
    - 4-Hydroxytamoxifen and endoxifen prodrugs
    - Targeted osmotic lysis therapy for cancer cells
    - Flufirvitide – influenza treatment
    - Mutant LT – vaccine adjuvant
    - Dengue fever vaccine
    - Programmable stem cells – rheumatoid arthritis treatment
    - Anti-polymer diagnostic
    - Lyme Disease Diagnostic for human use

    - Lyme Disease Diagnostic for veterinary use
    - Cancer Microarray Designs
    - Lassa Fever Diagnostic for human use
- Products in the development pipeline at Louisiana universities:
    - Ebola Disease diagnostic
    - Chewing gum-based drug delivery tool for timed release of drug
    - Soy-derived treatment for obesity and diabetes
    - New adhesive materials
    - Protein-binding materials for drug delivery
    - Method for microencapsulation of water soluble compounds
    - Novel ceramide analogues as treatment for chemoresistant breast cancer
    - Bisbenzamidines for treatment of human African Trypanosomiasis
    - Method of treating diabetic retinopathy
    - Hepatitis C Virus Replication inhibitors using siRNA combinations
    - Treatment for cytomegalovirus infection
    - Radiolabeled dye for the detection of sentinel lymph nodes
    - Assay to predict complications in diabetic patients
    - Pharmacoproteomic assay to determine a patient's response to a therapeutic agent
    - Diagnostic assay for traumatic brain injury
    - Diagnostic for Ataxia-telangiectasia
    - Cardiovascular disease treatments
    - THC-based therapies for neurodegenerative diseases
    - Vaccines and therapeutics for candidiasis and other fungal diseases
    - Novel materials to promote oral health
    - Material and method to prevent and treat ocular infection
    - Therapeutic oligonucleotide for the treatment of cancer
    - Boronic prodrugs for enhanced oral bioavailability
    - Anti-angiogenic and anti-metastatic drugs
    - Osteogenic compounds for osteoporosis in breast cancer patients

Technology Transfer Initiatives

- Leveraging Innovation for Technology Transfer ($LIFT^2$) FUND established at LSU's Office of the President – biannual awards of up to $50,000 to provide Proof-of-Concept funding to advance disclosed technologies.
- Louisiana Fund
- Louisiana MediFund

III. WORKFORCE DEVELOPMENT

III.A. Strategic Initiatives

Short Term Initiatives:

- Expand educational opportunities on intellectual property management, e.g., Technology Transfer and Commercialization course at LA Tech; practicum offered to Tulane Law students; relevant seminars hosted by New Orleans BioInnovation Center; courses offered to LSUHSC-NO faculty and students by the Office of Technology Management.

- Expand academic liaisons between Information Technology and research groups in science and medicine. Technology Services at Tulane is presently establishing such a liaison to be comprised of a system administrator and two computational scientists to help faculty researchers translate their computational models into code.
- Support Leger resolution No 134 for a formula-based financing model for graduate/medical education and biomedical health-related research.
- Support Appel Senate Bill No 337 to develop an outcome-based funding formula for postsecondary education.

Intermediate and Long Term Initiatives:

- Continue to develop existing training programs, e.g., Lean Process and Six Sigma Certification programs at LA Tech.
- Seek continued and expanded federal funding for relevant initiatives including IGERT, I-TEAM, I-CORPS and others.
- Health IT projects are often suitable to form start-ups around; Grow the number of health IT startups to create jobs and offer students training in important skills.
- Increase number of underrepresented minorities going to graduate school through NIH-funded Building Infrastructure Leading to Diversity (BUILD) funding.

III.B. Existing and Prospective Strengths

- NSF IGERT award to Donald Gaver, Biomedical Engineering, Tulane. This award supports a training period for doctoral candidates at the U.S. Food and Drug Administration (FDA) with the specific goals of building capacity, creating jobs and funding opportunities around biotechnology-based start-ups.
- NSF I-Team award to Michael Moore, Biomedical Engineering, Tulane.
- Significant funding from NIH (10 Centers for Biomedical Research Excellence, one Clinical Translational Center of Excellence, multiple other NIH-funded center grants). Total funding for 2013 is $133 million.
- In partnership with Tulane, LSU, their medical centers and 8 other research universities around the nation, Xavier has been awarded a $19.6M NIH BUILD grant to increase the number of African American Ph.Ds in the life sciences.
- Louisiana Workforce Commission-recognized primary training, certification, and job assistance available through LA Tech's Continuing Education and Distance Learning Program and the Global Campus.
- Fenway Xperience program at LA Tech: apprenticeship program for software developers in collaboration with The Fenway Group, a Dallas-based IT services company.
- BlueArx Partnership: apprenticeship program for students in marketing, journalism, graphic design, and technical writing in collaboration with BlueArx, Inc, a Shreveport-based digital marketing company.
- Louisiana's increasing clinical trials capacity is expected to increase product development and high wage jobs.
- Louisiana's increasing success with projects that lead to new treatment and prevention options will stimulate the creation of start-ups. Growing the number of start-ups will create jobs and offer workforce training in important skills.

IV. KEY PARTICIPANTS

Bruce Bunnell, Professor of Pharmacology and Director, Center for Stem Cell Research and Regenerative Medicine, Tulane

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