Title: **BoR MASTER PLAN STEM RESEARCH PRIORITIES REPORT – June 2013**
Campus: **LSU Agricultural Center**
Contact: **John S. Russin, Vice-Chancellor**

I. Identification and Definition of Priority Research Areas
- a. Priority Research Areas
  - i. Core Industry S&T Sectors
    1. Energy & Environment
       - a. Renewables & Energy Efficiency (Blue Ocean Target Industry)
         - i. One of a kind pilot plant for strategic research and development of liquid fuels and specialty chemicals from cellulose biomass and syrups (sugars) derived from biomass crops (energy cane, sweet sorghum) in the southern United States
           1. Existing industry partners – Virent, Inc; Optinol; Genencor Dannisco DuPont; Ceres, Inc; John Deere
           2. Other interested industries – Chevron Technology Ventures; Roquette France; Green Biologics, Inc
           3. University partners: Southern University, Morehead State University, University of Arkansas Monticello, University of Wisconsin Madison, Mississippi State University, USDA-ARS Sugarcane Research Laboratory – Houma

Success story: Long a leader in petrochemical industries, Louisiana largely had not been a player in technology development for producing liquid fuels and specialty chemicals from crop sources. This changed with establishment of the Louisiana Institute for Biofuels and Bioprocessing and its ensuing success to win a $17.2 M award that would help build the foundation for a biomass-based fuels and chemicals sector in the state. In addition to focusing on genetics of high-fiber 'energy cane' and sweet sorghum, this program will address logistics of harvest and transport of a biomass crop, create education programs for student and professional training in the biofuels arena, and build a dedicated pilot plant that will support specialized technology development for fuels and specialty chemicals from Louisiana crops. Numerous industry partners already have partnered with us to test their proprietary technologies using Louisiana feedstocks.

    2. Agriculture and Bio Prod
       - a. Food crop technology
         - i. Rice varieties
           1. Conventional rice --- nearly ⅔ of all rice acreage in southeast US rice region is planted to LSU AgCenter rice technologies (herbicide-resistant and traditional rice varieties)
           2. Specialty rice --- emerging aromatic rice industry in US, indirect competition with imports from south and southeast Asia, based on LSU AgCenter rice technology

Success story: Control of weeds, particularly red rice, historically has been a challenge for rice producers. LSU AgCenter scientists developed a unique, non-GMO herbicide-resistance technology that allows for effective control of problem weeds in rice. This genetic trait, now a licensed technology, is found in much of the rice acreage in the US and throughout the world and, where utilized, is helping to increase food production, enhance food quality, and stimulate economic development.

         - ii. Sweetpotato
           1. Construction of ConAgra Lamb Weston sweetpotato processing plant in Delhi, LA based on LSU AgCenter sweetpotato research program
           2. Nearly ½ half of all sweetpotato acreage in southeast US, and 75% of all such acreage in California, is planted to LSU AgCenter sweetpotato technologies

Success story: ConAgra Lamb Weston, one of the largest food processors, sited its sweet potato processing plant in Delhi, LA largely because of two reasons --- i) proximity to LSU AgCenter's dedicated Sweetpotato Research Station in Chase, LA and ii) strength and historical productivity of our sweetpotato variety development and production research programs. This plant now sources potatoes from Louisiana along with several surrounding states, provides 275 permanent jobs for Louisianans, and serves as an economic stimulus for northeast Louisiana. Further, LSU AgCenter breeders now provide sweetpotato lines that are well adapted to California growing conditions and are serving to revitalize that industry.

         - iii. Sugarcane
           1. A substantial portion of the acreage worldwide grown for sugar is planted to LSU AgCenter sugarcane technologies
           2. Emerging biomass production in southeast US will be based on LSU AgCenter 'energy' cane and sweet sorghum

  - ii. High Growth Target Industry
    1. Materials & Chemicals – from biobased materials
       - a. Bio-based production of specialty chemicals (see 1.a.i.1.a.i above)
         - i. Tiger Bullets – plastic and wood composite that prevents lost circulation in oil-drilling wells. Example: Product licensed to Hole Pluggers, LLC in New Iberia

Success story: TigerBullets is currently being manufactured by Wallace Molding and Millwork Inc., in Columbia, La. – a traditional wood products company – and is marketed by MI-Swaco Inc., in Houston, Tx (a Schlumberger company) and HolePluggers, LLC in New Iberia, La. So far, more than 3 million pounds of material have been manufactured and sold. The material has been used by major oil companies, including BP, Exxon, Chevron, XTO, Pioneer and OXY in more than 300 oil wells across the United States.

b. Food additives – chemical components and constituents for food product development. Example: Product licensed to H&B beverages for EX5 sports drink.

Success story: The LSU AgCenter Department of Food Science discovered a compound that blocks bitter and astringent flavors in foods and beverages. Potassium is an essential nutrient and the majority of the population consumes too much sodium and not enough potassium. This is particularly a problem in athletes who perspire a great deal and in senior citizens. Potassium is extremely bitter and as a result it is difficult to add sufficient levels of potassium to foods. The addition of our bitter blocker blocks the bitter taste of potassium (and calcium) resulting in the ability to formulate beverages and foods that are high in potassium.

In conjunction with H & B beverages, a sports recovery drink (EX-5) was developed that provided high levels of potassium, calcium and modest levels of sodium. The product is significantly more effective than national brands of sports recovery beverages and has the added benefit of only ¼ the sugar of other products. In addition to sports recovery, we have developed an alternative delivery for potassium for patients with congestive heart failure and patients with advanced kidney disease. We have also demonstrated the benefits of the technology to produce low sodium sausage products that maintain the preservative effect of salt by replacing sodium chloride with potassium chloride demonstrating a healthier preserved meat concept.

2. Energy Production
   a. Bio-based production of liquid fuels (see 1.a.i.1.a.i above)
   b. Continuous flow pyrolysis of biomass, using microwave technology, to produce biodiesel liquid fuel
3. Coastal Resilience
   a. Recent release and licensing of improved lives of 3 coastal plant species for revegetation of created wetlands in LA coastal areas
4. Biomedical
   a. Commercially available biomedical products
      i. University Products, LLC – vaccines for use in animal biomedical applications

Success story: University Products LLC is a company that specializes in the production of a unique vaccine that is effective against anaplasmosis, a serious disease of cattle. The vaccine was invented at the AgCenter Department of Veterinary Science by Dr. Donald Gene Luther, who is also the president of the company. It is available currently in 18 US states and territories. This particular treatment only affects bovine strains of the disease, which can cause anemia, weight loss and death in cattle. A number of different technologies are licensed, with several demonstrating great potential for commercial development.

      ii. Esperance Pharmaceuticals, Inc. – targeted cancer therapeutics
      iii. TransGenRx – protein-based pharmaceuticals (erythropoietin, human growth hormone, etc.)
      iv. Solubility technology – solubilize pharmaceuticals, food additives. Currently licensed to OmniSol, LLC.
      v. Nanoparticle delivery and encapsulation systems – encapsulated Vitamin E for atherosclerosis therapy
5. Bioengineered Solutions
   a. Nanoparticle delivery and encapsulation systems – encapsulated Vitamin E for atherosclerosis therapy (see I.a.ii.4.a.v above)

b. Brief narratives to justify each priority
   i. See descriptions above and Section II.c below
   ii. N/A
   iii. Data detailing research productivity

Category	2008		2009		2010		2011		2012	
Faculty Data										
Total Faculty #	282		278		276		258		241	
Total Faculty SY's	222.45		218.22		213.66		202.91		190.70	
Total # PI's and Co-PI's	254		250		248		232		217	
Award Data (#, amount)										
Federal	50	$6,715,568	62	$9,470,323	58	$6,132,322	44	$10,762,637	39	$3,757,168
State	41	$3,339,162	47	$3,042,426	38	$3,374,422	34	$2,864,781	29	$2,222,425
Industry	45	$1,211,636	59	$1,744,229	72	$2,775,626	52	$1,374,402	71	$1,725,038
Other - Gift	280	$1,316,919	292	$1,689,939	300	$2,041,526	274	$1,934,841	233	$1,770,670
Other - Commodity	126	$3,563,002	84	$3,182,140	103	$3,442,611	92	$3,438,305	87	$3,906,784
Other - Misc	50	$2,029,465	63	$2,733,408	50	$2,697,232	58	$2,238,754	44	$2,124,427
Other - Total	456	$6,909,386	439	$7,605,487	453	$8,181,369	424	$7,611,900	364	$7,801,881
Overall Total	592	$18,175,752	607	$21,862,465	621	$20,463,739	554	$22,613,720	503	$15,506,512

1. Publication data – 2012
    a. Total number of refereed journal articles – 375
    b. Total number of research publications – 1,021

c. Success stories – see appropriate sections above

d. Key institutional collaborations – see appropriate sections above

II. Institutional and External Support for Priority Research Areas

a. LSU AgCenter's priority research areas are an accurate reflection of our federal agricultural experiment station mission established 126 years ago by the Hatch Act. Our overall mission is to improve the quality of life for people through research and educational programs that enhance development of existing and new agricultural and related enterprises, develop human and community resources, and fulfill the acts of authorization and mandates of state and federal legislative bodies. Our overarching goal is to promote scientific investigation and experimentation bearing directly on and contributing to the establishment of a permanent and effective agricultural industry.

While many AgCenter research programs are more traditional in nature, an ever-growing number of our research initiatives represent the technological evolution that has occurred in many fields. For example, traditional home economics now has expanded and matured to embrace food science and technology, textile chemistry, human nutrition and health, etc. Similarly traditional forest product programs now have expanded to include composite technologies for construction, innovations in materials design, and an expanding array of industrial applications.

b. During 2011-2012, LSU AgCenter developed a long term business plan that identified core program areas that are critical for future mission-based success. These core programs are those that will receive resources in the future. Programs identified as non-core will be de-emphasized and unfunded over time, with resources being directed solely to sore areas.

c. Core and non-core programs were identified based on a number of criteria, including historical and future funding opportunities. Program areas with high funding potential and that are critical for Louisiana agriculture will receive emphasis in the future. Programs areas with low funding potential still will be emphasized if these are critical for Louisiana agriculture. Programs with high funding potential but little or no importance for Louisiana agriculture will not be emphasized. Our decision driver largely will be relevance and importance to Louisiana agricultural and related enterprises, not solely opportunity for funding.

III. Research and Economic Development Data

R&ED Data Category		2008	2009	2010	2011	2012
R&D expenditures	All	$17,166,163	$20,036,903	$21,237,634	$24,242,067	$25,159,352
	Federal	$3,229,282	$4,571,745	$5,134,604	$6,400,244	$7,124,901
	Industry	$5,454,645	$5,807,485	$5,058,975	$5,865,811	$6,094,782
Invention disclosures		31	33	33	25	27
Patents filed and issued		2	5	4	5	3
Licenses/options signed		6	7	17	18	9
Licensing income generated		$2,524,643.30	$5,969,066.01	$9,068,981.37	$10,620,788.63	$9,582,731
Start-up companies formed		0	3	0	2	1
Industry-sponsored research agreements		45	59	72	52	71