LOUISIANA STATE UNIVERSITY SYSTEM

2005-2010

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2010

2007

A Progress Report to the Community

PENNINGTON BIOMEDICAL RESEARCH CENTER

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In January 2005, we produced the Pennington Biomedical Research Center's second five-year strategic plan, *Vision 2010*. As we approach the mid-way point in that plan, it is an opportune time to review the progress we have made and the challenges we still face in achieving our goals for this five-year period.

With great pleasure, I offer ***Vision 2010 – A Progress Report to the Community***. I am pleased to submit this report to the President of the Louisiana State University System, the Board of Supervisors of the LSU System, the Board of Regents, the Board of the Pennington Medical Foundation, the Board of the Pennington Biomedical Research Foundation, faculty and employees of the Center, our state and city-parish officials and other civic leaders of Baton Rouge and Louisiana. All of them have helped us in some way to craft and achieve our goals during the last 19 years, and we are counting on them to help us achieve our ultimate vision – to be the best in the world at what we do.

Vision 2010 envisioned a five-year period of growth, not only in the breadth of our science, but primarily in its depth. A key component of the plan is to recruit new scientists in areas of research critical to our mission: "to promote healthier lives through research and education in nutrition and preventive medicine." To accomplish these goals, ***Vision 2010*** requires a substantial increase in revenues from state allocations, federal research grants, corporate research contracts and private donations. Of considerable importance in this regard, the Pennington Biomedical Research Foundation accepted the challenge of raising $10 million in unrestricted funds during the course of our five-year plan for the benefit of the Center.

I am pleased to report significant progress after two years in much of what we envisioned. As our research has increased in scope and sophistication, we have also enjoyed a continued rise in our position among our peers. We are proud to present this midcourse report to the friends of the Pennington Biomedical Research Center.

Current Status

Overview of Demographics

At the end of 2006, PBRC could count on the contributions of 175 scientists: 80 full time faculty level scientists, 40 postdoctoral fellows and 55 adjunct faculty from 37 different institutions. These scientists are supported by about 400 staff members.

PBRC enjoys about 430,000 square feet of research space plus more than 100,000 square feet devoted to administration and services. The Center operates a network of 48 research laboratories plus 19 core facilities designed to support the work of its scientists.

Our Science

The overarching goal of the research at PBRC is to prevent diseases and premature death. To fulfill its education mission, the Center has created a Division of Education. To fulfill its research mission, the Center has three large research programs: a basic science program, a clinical research program and a population science program. Current research priorities lie within six research divisions. These are:

- **Division of Nutrition and Chronic Diseases**
- **Division of Experimental Obesity**
- **Division of Functional Foods**
- **Division of Nutrition and the Brain**
- **Division of Clinical Obesity and Metabolic Syndrome**
- **Division of Health and Performance Enhancement**

Basic Science Programs

Scientists involved in these programs study the genetic, molecular, cellular and physiological mechanisms linking nutrition and other factors to common chronic diseases such as diabetes, heart disease, obesity and cancer. Our basic science programs are organized around eight major areas and 35 laboratories as summarized in the following table:

Basic Science Laboratories

Cancer
- DNA Damage and Repair
- William Hansel Cancer Prevention

Diabetes
- Antioxidant and Gene Regulation
- John S. McIlhenny Botanical Research
- Mechanisms of Diabetes Complications

Experimental Obesity
- Agouti Research
- Dietary Obesity
- Functional Genomics
- Infection and Obesity
- Neuroendocrine Immunology

Human Genomics
- Energy Balance
- Human Genomics

Molecular Genetics
- Molecular Genetics and Thermogenesis
- Neuropeptides
- Regulation of Gene Expression
- Taste Genetics

Neuroscience
- Autonomic Neuroscience
- Blood Brain Barrier I
- Blood Brain Barrier II
- Neurobehavior
- Neurobiology and Nutrition I
- Neurobiology and Nutrition II
- Neurosignaling
- Neurotrauma and Nutrition
- Nutritional Neuroscience and Aging

Nutrient Sensing
- Adipocyte Signaling
- Endocrinology
- John S. McIlhenny Skeletal Muscle Physiology
- Nuclear Receptor Biology
- Protein Structural Biology

Stem Cell Biology
- Developmental Biology
- Epigenetics and Nuclear Reprogramming
- Regenerative Biology
- Stem Cell Biology
- Ubiquitin Biology

Clinical Research Programs

Advances in basic research may lead to better disease prevention strategies or new therapeutic approaches. It is a major goal of clinical research to verify if such advances carry true benefits for human beings. To date, more than 20,000 Baton Rouge residents have participated in one of the 400 clinical studies that have been conducted at PBRC. These studies were designed to test the efficacy of various dietary prescriptions, new food products, food supplements, physical activity programs, weight loss regimens and new medications.
Our clinical research activities are distributed among four areas encompassing 13 laboratories as listed in the following table:

Clinical Research Units

Behavioral Approaches to the Prevention and Treatment of Obesity
- Behavioral Medicine
- Health Psychology
- Women's Health, Eating Behavior, and Smoking Cessation Programs

Clinical Physiology & Metabolism
- Exercise Biology
- Human Physiology
- Lipoproteins
- Stable Isotopes and Energy Expenditure

Clinical Trials
- Diet, Physical Activity and Behavior Modification Trials
- Pharmacology-based Clinical Trials

Epidemiology and Public Health
- Chronic Disease Epidemiology and Health Delivery
- Clinical Epidemiology
- Nutritional Epidemiology
- Preventive Medicine

Population Science Program

Population science is a new domain of activity for PBRC. We intend to devote considerable resources to growing this program over the next few years. By definition, population scientists are concerned with the characteristics that are associated with health and disease in large populations. This is obviously of great interest to PBRC as we try to translate research findings in disease prevention and better health status in communities and the population as a whole. As we needed space for this new program, we closed our conference center and converted it in part to space dedicated to population research. Moreover, with the support of the Pennington Medical Foundation, we were able to add a 15,000 square foot addition to the existing building. This new space together with the space recovered from the conference center should allow us to accommodate about 200 faculty and staff when this program reaches maturity.

Core Facilities

Research core facilities constitute major assets not only for our scientific programs but also in our efforts to recruit productive new investigators. Nineteen core facilities currently support basic science and clinical research activities at PBRC. These facilities are listed in the following table:

Core Facilities

Basic Research Cores
- Animal metabolism and behavior
- Cell biology and cell imaging
- Cell culture
- Comparative biology
- Genomics
- Proteomics
- Transgenics

Clinical Research Cores
- Biostatistics/data management
- Clinical chemistry
- Dietary assessment
- Exercise Testing
- Imaging/MRS
- In-patient
- Library
- Mass spectrometry
- Metabolic chambers
- Metabolic kitchen
- Out-patient
- Recruitment

Education Programs

Our Division of Education conducts professional and public education activities. The Division organizes a minimum of two scientific symposia each year, inviting world leaders to Baton Rouge to discuss not just their published findings, but also their current unpublished work. The goal of these meetings is to push science forward through discussion, challenge and debate. In addition, the Division has teamed up with Louisiana State University's Agriculture Center, including its "county agents," to create and distribute meaningful educational literature on nutrition and related topics to the population of Louisiana. This Division also manages the PBRC postdoctoral training program.

Postdoctoral Training Program

Postdoctoral researchers are essential to PBRC's mission, and are responsible for a significant proportion of the research productivity. Strengthening and increasing our postdoc population is a priority of ***Vision 2010***.

The Center currently employs 40 postdocs, recruited to work primarily on specific National Institutes of Health (NIH) research projects. A small number are also funded by our own NIH institutional postdoctoral training grant. The Center is enjoying a growing pool of postdoc applicants and has created a specific training program to develop the most promising candidates into fully prepared, successful and independent researchers capable of securing their own research funding. The following table gives the number of applications received for the small number of positions that we could offer. It is clear that we could have a much larger postdoc program if we had the financial resources to offer more positions.

Financial Status of the Center

At the start of ***Vision 2010,*** the Center functioned on an annual budget of $40 million, our baseline from which to plan the next five years. ***Vision 2010*** called for a near doubling of operating revenue and an injection of $50 million in capital investment. The plan called for a global investment of $350 million in operating and capital revenue over the five-year period.

The FY 06-07 operating budget of PBRC has grown to $53 million, with $12 million coming from the State of Louisiana general fund. Since the opening of the Center in 1988, a total of $545 million has been spent for capital and operating expenses. Out of this total, the contribution from the State of Louisiana over 19 years represents 21 percent. Federal grants (primarily from the National Institutes of Health) and other grants and contracts from out of state corporations and agencies constitute about 60 percent of the funds expended at PBRC since its opening. In this regard, it is of interest to note that among the 3,419 institutions that received funds from the National Institutes of Health in 2005, the latest year for which such data is available, PBRC ranked 207th in amount of funding received.

Historically, the Center has received a yearly state appropriation from the general fund ranging from 20 to 25 percent of its operating budget. This state contribution has proven to be extremely productive. State allocations constitute unrestricted funds from which we can draw to recruit new scientists, operate our facilities and provide the business, computing, communications, and staff support needed. We hope that the same level of contributions from the state legislature relative to the overall operating budget of the Center will be maintained in the future.

Mid Course Review of the Vision 2010 Goals

Overview

An ambitious five-year plan was launched in 2005, guided by the following four long-term goals:

1. **Build a world-class research center in nutrition and preventive medicine;**
2. **Generate cutting edge and influential research;**
3. **Maximize the benefits of technological advances and new discoveries made at the Center; and**
4. **Contribute to the economic development of the State of Louisiana.**

We have made considerable progress towards the goals of ***Vision 2010***. For instance, we created a new research division, recruited key senior and several junior researchers, and won three sizable federal "center" grants. Our researchers continue to lead the way in a number of the following research areas: the role of viruses in obesity; new compounds to simulate the body's response to caloric restriction; the search for botanical compounds that could ward off diabetes years before it develops; directing the destiny of adult stem cells derived from adipose (fat) tissue; cross-talk among various regions of the brain and between the brain and the gastrointestinal tract; *in utero* influences on postnatal gene expression and on physiology and behavior; and innovative approaches to inducing and maintaining weight loss, among many others.

Advances of the last two years can be best understood by reviewing what has been accomplished for each of the 10 priorities of the Vision 2010 Strategic Plan.

Postdoctoral Corps for Years 1998-2005

TRAINEES	1998	1999	2000	2001	2002	2003	2004	2005
A. Formally Applied	49	77	98	109	155	270	176	291
B. Offered Admission	5	18	17	14	18	16	18	14
C. Number who entered	5	15	12	12	16	15	18	14

Priorities

Priority 1

Establish a Division of Nutrition and the Brain.

Dr. Weihong Pan is now Division Chief of the new, fully functional Division of Nutrition and the Brain. The Division can count on the contributions of 17 scientists. Since the plan was launched in 2005, Drs. Don Ingram, Paul Pistell, Rudolph Schicho, Hong Tu, and Jun Zhou have joined the ranks of this Division.

Priority 2

Expand Comparative Biology and enhance Transgenic Animal Core.

Dr. Barry Robert has joined the Center and is the veterinarian responsible for the Comparative Biology facility. A 4,000 sq. ft. addition has been completed with funding from the NIH. However, much more space is needed to accommodate the growth of the basic science programs. More resources have been added to the Transgenic Core.

Priority 3

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Increase expertise in developmental biology and genetic epidemiology.

We have filled the Peggy M. Pennington Cole Chair in Maternal Biology (Dr. Claudia Kappen), and other key areas such as neuroendocrine immunology and aging (Dr. Vishwa Dixit), developmental biology (Dr. Claudia Kruger), genetic epidemiology (Dr. Nathan Markward), regulation of gene expression (Dr. Michael Salbaum), cell biology and cell imaging (Dr. David Burk), drug development (Dr. Tada Utsuki) and cell signaling (Dr. Tom Burris). Additionally, Dr. Indu Kheterpal joined the Center as Director of the Proteomics Core and leader of the structural protein biology laboratory.

Priority 4

Expand Clinical Research, Population Research and Imaging facilities.

A new Magnetic Resonance Spectroscopy laboratory is now operational. This unit allows researchers to make non-invasive measurements of the molecular make-up of brain, muscle, fat and bone tissue of clinical participants. A new 15,000 sq. ft. Population Science wing has been added to the Claude B. Pennington, Jr. building with the $5 million cost underwritten by the Pennington Medical Foundation. It will house population science faculty and support staff. Recent additions to the faculty in population science include Dr. Ronald Horswell (biostatistics) and Dr. Valerie Myers (clinical psychology).

The construction of a new 80,000 sq. ft. Clinical Research building remains the top priority for the Center. We have charged Mr. William Silvia, formerly Executive Vice-President for the LSU System, with the responsibility of putting together the financing for this $25 million construction project.

Priority 5

Increase expertise in pediatric obesity, aging, metabolic syndrome, physical activity and wellness, minority health behaviors and population health assessment.

Dr. Tim Church, public health, preventive medicine and physical activity specialist, has joined the faculty as the John S. McIlhenny Endowed Chair in Health Wisdom. We have also successfully recruited the following faculty in this area: Dr. Stephen Anton, health behavior, Dr. Leanne Redman, reproductive biology and women's health, and Dr. Conrad Earnest, functional foods and exercise biology.

Priority 6

Secure NIH center grants and obtain designation and funding as a satellite of an NIH-funded GCRC.

Three federal grants have enabled us to establish centers of research excellence at PBRC. The Clinical Nutrition Research Unit (CNRU) central research theme is the maternal, pre-natal, peri-natal and epigenetic network of factors that may predispose to obesity and metabolic diseases. The Botanical Research Center (BRC) focuses on finding and testing botanical compounds that may prevent diabetes or serve as functional adjuncts in the treatment of diabetes and the metabolic syndrome. Additionally, we were awarded a five-year grant to establish a NIH-Center of Biological Research Excellence (COBRE) to support promising young faculty members. This grant funds the research of these future leaders as they establish their laboratories and research programs.

Finally, we secured a planning grant from NIH to fund our application for a Louisiana NIH Clinical and Translational Science award. Along with support from the three medical schools in Louisiana and other campuses, our goal is to win the grant and establish a Louisiana Clinical & Translational Research Center.

Priority 7

Expand the postdoctoral program.

An additional position has been added to our existing NIH T-32 Training Grant for postdoctoral fellows. A second T-32 application is under development for submission to NIH later this year. We have more clearly defined the position of postdoctoral fellow, which now includes a structured series of lectures in nutrition science and metabolism, and seminars in

research ethics and professional development as well as grant writing.

Priority 8

Expand community and professional education efforts.

We have consolidated our symposium and conference activities. Our collaboration with the LSU Agricultural Center in the dissemination of information on nutrition and health continues to expand.

Priority 9

Pursue partnerships to establish a wellness center with research-based wellness programs.

A feasibility study has been completed, and discussion is ongoing with potential partners and investors. Again, Mr. W. Silvia has been asked to work towards securing the financing for this project.

Priority 10

Expand the administrative and service resources to sustain the growth of the research and education programs.

Expansion of services in this area is proceeding apace with Center needs. Thus, we have added about 15 new positions in the last two years to administrative services.

Plans for the Second Half of the Strategic Plan Period: 2007-2010

Overview

Despite the negative effects of hurricanes Katrina and Rita on the economy of Louisiana, we believe that we will accomplish most, if not all, of what we set out to do in ***Vision 2010***. While continuing to focus on the ten priorities of the Strategic Plan, as reviewed in this midcourse report, it will be important for us to devote time and energy to a number of major opportunities and issues.

Partnership with USDA

Early in the five-year strategic plan, PBRC and the U.S. Department of Agriculture jointly signed a Memorandum of Understanding to create a long-term research partnership. The USDA is particularly interested in large-scale research programs focused on significant societal issues of obesity and nutrition. The seed of a large, long-term USDA research center at PBRC was planted when the first of this USDA funding and our first USDA scientist-in-residence arrived early in our strategic plan period. We are hopeful this small step will eventually grow into a significant research program, complementing nicely with existing PBRC research.

Louisiana Clinical and Translational Science Center

Two years ago, the Director of the National Institutes of Health announced the Roadmap for Medical Research. One of the key aspects of the Roadmap is the re-engineering of the clinical research enterprise. The NIH is investing heavily in clinical research and its re-engineering. The organization has funded the first 12 of an eventual 60 Clinical and Translational Science Awards (CTSAs). These awards are for $6 million annual funding and are ongoing. PBRC is the recipient of a Planning Grant to bring a CTSA to Louisiana. The Louisiana Clinical and Translational Science Center (LA CaTS Center) will synergize and catalyze the advancement of clinical and translational research in Louisiana. The vision for the LA CaTS Center is to engage clinical and translational researchers throughout the state, with the LA CaTS Center serving as a platform to supply research resources to translational researchers throughout Louisiana.

Clinical Research Facility

PBRC is now in the undesirable position of turning away some clinical studies and slowing the recruiting of medically qualified faculty due to a lack of capacity for clinical investigations. Our plan calls for the construction of an 80,000 sq. ft. building for clinical research. The new facility would house about 300 faculty and staff. The building would also include space to headquarter the Louisiana Clinical and Translational Science Center. This expansion is estimated to cost $25 million. In previous years, more than $2.5 million have been spent on this project for design and architectural fees, new parking surface and linkages with the physical plant. These funds came primarily from the Pennington Medical Foundation with a contribution from the Louisiana Department of Economic Development. The proposed facility should have a major impact on our portfolio of grants from the NIH and contracts from the pharmaceutical industry

Contributions to Economic Development

PBRC has the potential to be a major economic development institution. We expect that the Center will play a growing role in the state economy as it continues to bring in more federal grants and private sector contracts, to attract more postdoctoral fellows from out-of-state, to generate more technology disclosures, patents and licensed technologies, and to spin off knowledge-based companies. During the last ten years, PBRC has been one of the most productive

investments made by the State of Louisiana. Thus the $115 million contributed by the state since the opening of the Center have made it possible to attract more than $310 million in grants and contracts plus contributions of $116 million from the Pennington Medical Foundation for construction, equipment and general support during the last 19 years. Overall, PBRC has proven to be an excellent investment and promises to be an even greater economic engine in the future.

Overview of Technology Transfer Activities at PBRC

Fiscal Year	Technology Disclosures	Patent Applications	Licensed Technologies
1988-1995	1	2	1
1995-2000	10	4	2
2000-2005	39	12	46
2006	19	12	10

This is well exemplified in the data summarized in the above table. All indicators of technology transfer activities reveal that PBRC is poised to make important contributions to our economy. Indeed technology disclosures, patent applications and licensed technologies have all increased substantially in recent years. We believe that the technology transfer portfolio of PBRC will grow even more spectacularly in the next five years.

The creation of a venture fund (Themelios) devoted primarily to the intellectual properties developed at PBRC combined with the availability of other similar funds in Louisiana, such as Louisiana Fund 1, should greatly favor this increased participation to the economic development on the part of the Center's scientists.

Positioning PBRC for the Future

The Nutrition Research Mission

In its short history, PBRC has focused its clinical and population research programs on the characteristics of a healthy diet, on the conditions under which a healthy weight can be maintained or recovered, and on the role of regular physical activity. Nutrients and other food compounds are also a strong research pursuit as we discover more about their biological and curative properties.

However, it is important to recognize that our research mission is two-fold: "research in nutrition and preventive medicine." As we plan for the future, it is obvious that we need to strengthen our preventive medicine programs.

The Preventive Medicine Mission

There are about 2.5 million deaths per year in the USA. Most of these deaths are attributable to common conditions such as heart disease, stroke, cancer, diabetes and obesity, to adverse lifestyle choices as exemplified by smoking, poor nutrition and a sedentary lifestyle, and to a lack of education or poverty. A substantial fraction of these deaths is preventable. Research programs designed to define the most successful prevention programs and how to deliver them effectively are going to play a major role in this regard.

As the population gets older, with many more Americans living 80 years of age and beyond, preserving personal autonomy and a high quality of life have moved into the forefront of the health agenda. It is in preserving a full, healthy life as we advance in age that presents the most meaningful opportunity for the Center to make unique contributions. Indeed, there is not one single cause accounting for the way we look and feel as we get older. It is evident that one's genes play a critical role, but nutrition and physical activity are also two important determinants of the decline in overall physical and cognitive independence and in well-being associated with aging.

Much research in this area focuses on prevention of early death. Death rates, however, do not fully represent the reality of health and well-being. Quality of life is extremely important, particularly as one gets older. In this regard, preventing morbidities and remaining free from disability are of the utmost importance. However, it would be shortsighted to focus only on the period after retirement to study the mechanisms and conditions under which the prevention of physical and mental deterioration can occur. Prevention should begin as early in life as possible and, as a result, the Center should continue to make important investments in developmental biology, maternal biology and pediatrics.

Prevention of Diseases: The PBRC Paradigm

The table on the following page identifies twelve behavioral traits that are commonly recognized in state-of-the-art preventive medicine strategies and new measures that are likely to be part of the preventive medicine measures of the future. The Center has already invested heavily in the areas that are most likely to provide scientific advances in the next generation of preventive medicine. These include individualized and genomic-based prevention programs, functional foods and botanicals with favorable effects on target tissues and organs and specific pharmacological molecules designed for preventive medicine purpose, as well as stem cell and gene targeted research. PBRC has established basic research efforts in these areas to be in the forefront of disease prevention programs in the coming decade.

Prevention of Diseases: The PBRC Paradigm

State-of-the-Art Prevention

Smoking cessation
No illicit drugs
Healthy diet
Safe sex practices
Regular exercise
Proper hygiene
Stress management
An aspirin a day
Healthy weight
Fiber capsules
Seat belt usage
Vitamin supplements

Next Generation Prevention

All the preceding plus:
Genomic-based prevention
Targeted functional foods
Specific pharmaco-preventative compounds

Prevention in the Future

All the preceding plus:
Stem-cell based enhancement or replacement
Targeted gene preventive measures

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Ensuring our competitiveness

The competitiveness of the Center's scientists is likely to be maintained and even to increase in the future for two main reasons. First, each faculty at PBRC is on soft money and has to cover his or her salary from grants and contracts. In practice, when one considers the whole range of faculty from Instructors to Full Professors, including new arrivals, about 80 percent of salaries and benefits are covered by these sources. The second reason is that PBRC does not offer full tenure. Most faculty and all postdoctoral fellows are on one year, renewable contracts. About 40 percent of faculty is on a five-year rolling tenure system. These two factors are greatly contributing to the success of the Center by placing an emphasis on productivity. For instance, each PBRC scientist brings on average $400,000 of external research funds every year. Collectively, PBRC scientists have published more than 7,000 peer-reviewed scientific papers in their career and their research has been cited more than 160,000 times in the scientific literature. About one third of these scientific publications are the result of research performed at the Center's Baton Rouge campus.

In addition, our scientists and their research, through the competitive funding process and the peer-review system of scientific publication, are regularly evaluated and critiqued. We also convened our Center external advisory board in 2006 and will bring the board again to Baton Rouge in 2008 to advise us on global priorities and strategies. These external advisors are instrumental in maintaining our research excellence and in advising us on the depth and breadth of our research enterprise. We will also undertake an external, extensive review of each of our six research divisions in the fall of 2007 and again just before the end of the current five-year Strategic Plan.

Finally, in addition to all the milestones we have placed ahead of us, before Vision 2010 is completed, we will have seen our 20th year anniversary come and go. Preparations are underway to mark this significant event in 2008: two decades of scientific discovery and a positive economic impact for Baton Rouge and Louisiana.