South Carolina’s Centenary Plan has created a new pool of intellectual capital and generated impressive gains in research productivity.

Art and science meet in an NSF-sponsored research grant.
The University of South Carolina is in the midst of another innovative period and a productive year for research. As we move forward in our commitment to excel in research and scholarship, our academic community is being stimulated by fresh minds and new ideas.

The Centenary Plan was launched in 2004 in response to the impending retirement of hundreds of professors of the Baby Boom era. We took this once-in-a-generation challenge and turned it into an intellectual investment opportunity. Since the program’s inception, 87 professors have been hired and/or approved for the program from a vast array of disciplines including art, physics and astronomy, public health, biochemistry, pharmacology, and many others. The return for this investment, measured in intellectual capital, has been huge and continues to grow. You will read more about the Centenary Plan’s success in this issue.

Carolina continues to produce new research stars through another state-wide initiative, the S.C. Commission on Higher Education’s Centers for Economic Excellence (CoEE) program. Since 2003, Carolina has been awarded $28.5 million for seven centers, and $21.3 million for joint ventures with other S.C. research universities. In the most recent award year, we received funding for centers focused on

- strategic approaches to clean coal
- rehabilitation and reconstruction sciences
- health care quality
- and the SeniorSMART Center, which you can read about in this issue.

Clearly, we are striving to accomplish more each year, and with our stellar faculty and committed staff we should achieve our goals.

This issue of Breakthrough, while showcasing some of our major accomplishments, just scratches the surface of our research and scholarship. I hope you enjoy this taste of what the University is doing to advance knowledge, increase economic development, and to improve the lives of South Carolinians and people everywhere.

Harris Pastides, Vice President for Research and Health Sciences
University of South Carolina
www.sc.edu/research
Blue chip investment
A bold plan to recruit 100 new research faculty members is paying a handsome return on the investment.

Alert and Mobile
South Carolina’s new SeniorSMART Center is good news for a graying population that’s anxious to maintain its independence.

Fighting back
The re-emergence of tuberculosis is a serious public health concern, and Ana López-Defede is serious about addressing the threat.

Biology, poetry, and nanorod marimbas
An innovative project brings science and humanities together in the lab to explore new frontiers in cardiac research.

Full steam ahead
The School of Medicine’s new dean has boarded a ship well underway toward its goal of teaching and research excellence.
The cure for tuberculosis (TB) has existed for 50 years. Yet one-third of the world’s population has been exposed to the TB bacterium that causes the disease, which commonly attacks the lungs and kills 1.6 million people worldwide every year. It’s the leading cause of death from infectious disease.

“TB anywhere is TB everywhere,” said Ana López-De Fede, research associate professor at the University of South Carolina Institute for Families in Society and a leading TB researcher. “It’s an airborne disease, which means we are all at risk.”

López-De Fede is a TB researcher, funded by the Centers for Disease Control (CDC), and a member of the National Advisory Council for the Elimination of Tuberculosis, appointed by the federal Health and Human Services secretary.

“As a council, we provide oversight of all efforts to combat tuberculosis,” López-De Fede said. As a researcher, she was among the first to receive CDC funding to study the social and cultural determinants of TB.

López-De Fede’s efforts are needed now more than ever. Some 150,000 South Carolinians are believed to be infected with TB, which is the highest number of TB cases in the Southeastern United States. Within the past 10 years, there has been a drastic increase in TB among African-Americans in the United States, especially in South Carolina, which ranks third nationally in the number of cases present within the African-American population.

**Re-emergence of TB as a public health threat**

In the 1960s, TB was no longer considered a public health threat, so the focus—and research funds—shifted to other areas.

“The CDC (Centers for Disease Control) pulled out all funding for TB,” López-De Fede said. “Then we were hit with the AIDS epidemic.”

Most people who die with AIDS actually die from TB. Groups most at risk for TB include those whose immune systems are compromised, those who have health complications such as diabetes and high blood pressure, people who are malnourished, those who stress their bodies through substance abuse, and people in geographic locations where there are active TB cases. TB can flourish where people live close together, such as nursing homes and prisons.

Even when TB wasn’t a concern in the United States, the disease was still present—and killing people—in other parts of the world, López-De Fede said.

Two things have since led to TB’s re-emergence in the United States. Though TB is curable, the cure requires drugs that must be taken with regularity for up to a year. People in poor countries frequently have limited and sporadic access to these drugs, and their course of treatment is often not completed—they are not cured, and the bacteria’s exposure to antibiotics promotes drug-resistance. At the same time, increased world travel and immigrating populations have helped to spread the disease, including into the United States.

“TB becomes drug resistant when the antibiotics that are our first line of defense don’t work. People stop and start treatment. TB suppresses itself again, and then comes back more forcefully,” López-De Fede said.

Since TB anywhere is TB everywhere, what is the best way to protect the public health?

“Here in the United States, TB infection rates are so low that there is no need for universal screening,” said López-De Fede. “A better strategy is to screen high-risk groups.”

The most high-risk groups have been immigrants from countries where the disease is present, such as Russia, Africa, and Thailand. That’s where public health officials have put their resources. But another segment of society is now experiencing a TB comeback: African-American communities in the Southeastern United States.

Carolina researchers such as López-De Fede are taking a multifaceted approach to examine the factors that contribute to this re-emergence, particularly in these high risk populations, and developing methods to address them.
López-De Fede’s research, in collaboration with the CDC and South Carolina’s Department of Health and Environmental Control (DHEC), explores why these populations are experiencing high rates of infection—and also why they are resisting treatment. The study compares three sites in South Carolina, Georgia, and Chicago.

“We can genotype the TB strains, so it made sense to look at these three areas because there is a lot of movement among the African-Americans between these Southeast and Northern geographic pockets,” López-De Fede said. “Our job was not only to look at communities, but also to look at common themes that ran across the TB cases.”

What the researchers found was that there are many barriers to diagnosis and treatment for infected African-Americans. Many were exposed to TB and unaware of it.

“If you’re exposed, it’s important to get treatment,” López-De Fede said. “One individual in five who has a latent form of the disease will develop symptoms within five to ten years.”

What is TB?

TB is a contagious but curable bacterial disease that spreads through the air.

- It can be active or latent; if it is latent, it remains in the body and can become active later.
- It is spread through the air, which means it is often transmitted in facilities where people live in close quarters, such as prisons, shelters, and nursing homes.
- It can attack any part of the body, but usually attacks the lungs.

“TB is still not widely understood. Because of the stigma that TB is associated with HIV/AIDS, people infected with TB would not tell others that they had the disease even if they didn’t have HIV/AIDS,” López-De Fede said. “For many of the people in our study, they wouldn’t tell us who they were socializing with—they didn’t want to.”

This made locating potentially infected people more difficult. Frequently, TB infected multiple generations of the same family.

“What our research did was provide a framework for how we can provide effective treatment that is culturally appropriate, whether or not you have health insurance. We focused on how to remove the barriers to diagnosis and treatment,” López-De Fede said. “TB is here. It is a threat we can do something about. What we need to do is be sure the individual enters treatment and completes treatment.”

Gail Burns-Grant, project officer at the CDC in the division of TB elimination, said research findings from López-De Fede’s project are important in the fight against the disease.

“Ana’s work didn’t focus on the interventions, but it was very important in helping us realize what we need to do nationally in project areas that have a high rate of TB in U.S.-born African-Americans, in the places where it is now emerging,” Burns-Grant said.

“U.S.-born African-Americans and foreign born people have a disproportionate rate of TB infection. With Ana’s work, we realize that though there are similarities in what we need to do to treat these population segments, there are differences. Her work showed us that we must ensure that the interventions we roll out with our partners are culturally appropriate.

“People like to blame marginalized people for the disease,” said López-De Fede. “But the truth is that we do a poor job of protecting them. We can never think public health issues are just domestic. We must have a global perspective.”

Medical School Researchers Test New TB Screening Test in Field

Traditional TB screening protocols present their own barriers to diagnosis and treatment. Public health officials look forward to the day when QuantiFERON®-TB Gold is in widespread use.

This new TB screening test, which was field tested by Carolina researchers, is faster and more accurate than the old skin-prick test. QuantiFERON®-TB Gold is a blood test that requires one patient visit, unlike the skin-prick test, which requires a follow-up visit for test interpretation. The new blood test gives results within 24 hours, and, unlike the tuberculin skin test, doesn’t have the potential to trigger the body’s immune responses, which might cause a false positive in a later TB test.

The work on QuantiFERON®-TB Gold is being spearheaded by Robert Best and Anthony Gregg in Carolina’s Department of Obstetrics and Gynecology and holds great promise in the fight to eliminate tuberculosis.
Fetal nicotine exposure might correlate with future drug abuse

Children whose mothers smoked while pregnant might be more susceptible to abusing cocaine and methamphetamine as adolescents, said a University psychology faculty member who is studying the phenomenon.

Steven Harrod, an assistant professor of psychology, is focusing on the neurobiological correlates of fetal nicotine exposure, using a four-year, $1 million grant from the National Institute on Drug Abuse. He has hypothesized that such exposure makes adolescents, particularly females, more vulnerable to abusing brain-stimulating drugs.

“I’m interested in understanding the neurobehavioral changes that might happen as a result of nicotine exposure in the womb,” said Harrod, who uses rodent models to mimic the rate and intensity of exposure. “Epidemiologists have previously shown that only 0 percent of female nicotine-dependent smokers actually quit smoking during pregnancy.”

Harrod’s model reproduces the brain spikes of nicotine exposure that mimic actual smoking behavior. He surmises that gestational nicotine exposure will later increase the stimulant effects of cocaine and methamphetamine in adolescent brains.

“Does that mean that every adolescent who was exposed to nicotine in the womb will go on to abuse such drugs? Of course not, but it could alter their neurotransmitters in such a way as to make them more vulnerable to psycho-stimulants if they ever experiment with them,” Harrod said.

Neuroscientists have identified a motivational circuit in the brain that is fed by brain chemicals and which affects mood and reinforcement of behaviors. It’s possible that fetal nicotine exposure might alter this circuit in a way that would reinforce drug-abusing behavior.

“If you’re going to create some kind of pharmacotherapy to help adolescents who are abusing drugs, you have to understand all of the neurobiological variables,” Harrod said. “This kind of basic research is aimed at trying to understand the complex world of drug-taking behavior.

“The reason I’m looking at adolescent drug use is because drug abuse doesn’t start in adulthood—it begins during adolescence.”
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