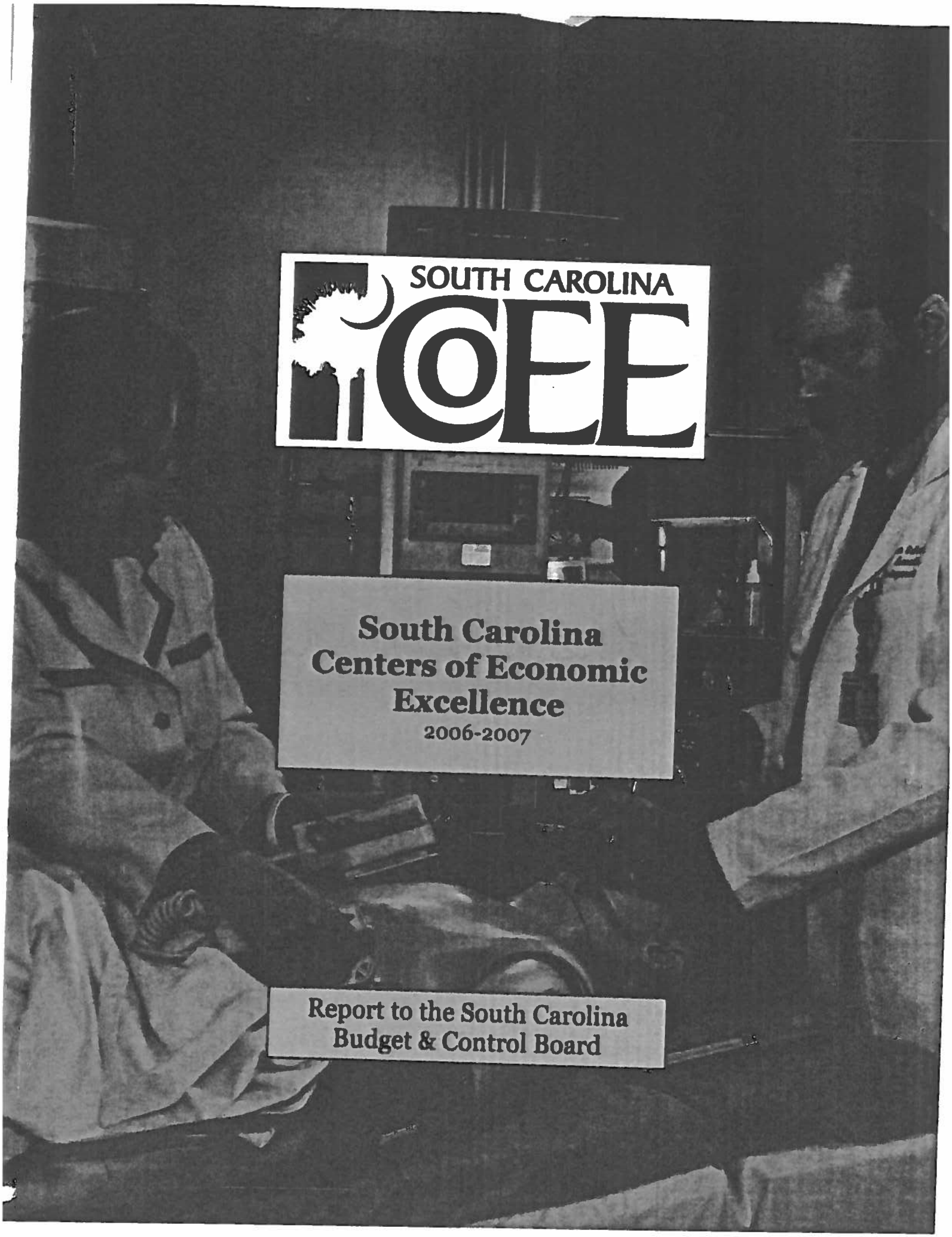

South Carolina Centers of Economic Excellence

2006-2007

Report to the South Carolina Budget & Control Board

[CoEE program information for FY 2008 is indicated in brackets.
The FY 2008 report will be issued at the beginning of the 2009 calendar year.]

[COVER PHOTOGRAPH: MUSC College of Nursing Dean, Dr. Gail Stuart (left), and Clinical Effectiveness & Patient Safety CoEE chair, Dr. John Schaefer (right), demonstrate resuscitation techniques on a simulator mannequin.]

MESSAGE FROM THE CHAIR OF THE SOUTH CAROLINA CENTERS OF ECONOMIC EXCELLENCE REVIEW BOARD

Most people probably think that the average research university is filled with scientists who spend their days examining liquid-filled beakers and complex mechanical devices. However, today's academic researcher is a well-groomed combination of technician and entrepreneur, a person who can lecture at a chalkboard and negotiate in a board room.

Distinguished patent attorney Howard Bremer once wrote: "[T]he university sector has made a tangible contribution to the competitiveness of the United States in a global market through the technology transfer function...." University research has indeed become a cornerstone of the new knowledge-based economy; however, many people are unaware of the legislation that revolutionized how universities approach and act upon scientific discovery.

In 1980, U.S. Congress passed the Bayh-Dole Act, which made it easier for universities to license scientific discoveries. Previously, discoveries that resulted from federally-funded research projects became the exclusive property of Uncle Sam. But Bayh-Dole allowed universities to retain ownership of federally-funded discoveries and compelled them to seek commercial development partnerships. In the decade and a half following Bayh-Dole, universities filed more than 11,000 patent applications (a 300% annual increase). Between 1980 and 2002, more than 2,000 research-related businesses "spun off" from university laboratories, accounting for one quarter-million new jobs and $40 billion in revenue.

Over the past six years, South Carolinians have witnessed businesses position themselves near the state's three research institutions: Clemson University, University of South Carolina, and the Medical University of South Carolina. This is because in 2002 the General Assembly recognized the opportunities of the knowledge-based economy and enacted its own innovation revolution: the South Carolina Research Centers of Economic Excellence Act.

This Act created the South Carolina Centers of Economic Excellence (CoEE) Program (also known as the Endowed Chairs Program). The CoEE Review Board is charged with awarding $200 million in Education Lottery proceeds to help the state's research universities attract non-state investment in advanced research which is likely to have commercial applications. Each CoEE research center is awarded between $2 million and $5 million, which must be matched dollar-for-dollar by non-state investment dollars. Both state and non-state funds are then used by the research institutions to attract world-class researchers in specialized, knowledge-based fields, such as nanotechnology, cancer research or automotive engineering.

At the end of the 2007 fiscal year, the CoEE Review Board had awarded $144 million (of $150 million appropriated), creating 34 CoEE research centers and 61 unique CoEE endowed professorships to lead them. Eleven endowed professors had been appointed. And within the program's first five years (2003 to 2007), the research institutions had acquired $89 million in non-state matching pledges (62% of total match required), with more than $62 million in pledges already received and invested in the South Carolina economy.

Information in this report extends through FY 2007. However, the CoEE Program has made major strides in FY 2008 as well. As I write this, matched pledges now exceed $124 million (an increase of $35 million in one year and 83% of the total match required), with more than $83 million in pledges received. In addition, ten more internationally renowned scientists have been appointed as CoEE endowed chairs, bringing the total number to 21.

The 2007 report contains numerous examples of how the CoEE Program has impacted the state's economy and enhanced our quality of life. One such example is the founding of Health Sciences South Carolina (HSSC), a unique, public-private healthcare partnership that has emerged because of the unprecedented collaboration sparked by the CoEE Program. (HSSC president, Dr. Jay Moskowitz, is himself a 2008 CoEE endowed chair appointment.) Coupled with three regional healthcare systems, our state's research institutions are on their way to becoming a national leader in health care research and have recently attracted a $21 million CoEE investment from the Duke Endowment.

Other 2007 highlights include the creation of seven new Centers of Economic Excellence, three of which have already received full non-state matching pledges. One of the donors, Smith & Nephew Corporation, is a global producer of medical devices with annual sales of $2.8 billion. Five CoEE endowed chairs were appointed in 2007, including Dr. Todd Hubing as the Michelin CoEE Endowed Chair in Vehicular Electronic Systems Integration. Dr. Hubing's research has major applications for the development of an efficient electric car.

On behalf of the CoEE Review Board, our deepest thanks are due to the General Assembly for its attentiveness to our state's economic future. Writer Thomas Friedman recently introduced the concept of a "flat world," where in the new global economy all players conduct business on a level playing field. However, because of the wisdom of our state's politicians and leaders, South Carolina's economic prospects are anything but flat. I have no doubt that we are headed in a positively upward direction.

SOUTH CAROLINA CoEE

Paula Harper Bethea
Chair, SC Centers of Economic Excellence Review Board
June 2008

South Carolina Centers of Economic Excellence
2006-2007 Report to the South Carolina Budget & Control Board

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Stroke experts and CoEE chairs, Drs. Marc Chimowitz (left) and Robert Adams (right), examine brain scans using telemedicine methods that will provide immediate advice to rural physicians caring for patients with acute stroke symptoms.

Executive Summary

PROGRAM SUMMARY

In 2002, the South Carolina General Assembly enacted the South Carolina Research Centers of Economic Excellence Act (Act). The legislation designated $200 million through 2010 from the South Carolina Education Lottery to establish Centers of Economic Excellence by creating unique endowed professorships at South Carolina's three senior research institutions: Clemson University, the University of South Carolina, and the Medical University of South Carolina. Each Center of Economic Excellence (CoEE) specializes in knowledge-economy research in fields such as engineering, nanotechnology, biomedicine, energy science, environmental science, and information and management science. The world-class scientists hired to become CoEE chairs will secure major private sector funding and federal grants for the state and over time will increase the state's knowledge base and stimulate the state's economy.

A nine-member Review Board appointed by the Governor, the President Pro Tempore of the Senate, and the Speaker of the House of Representatives approves new CoEEs and provides program oversight. The three research university presidents serve as ex-officio, non-voting members of the Review Board. Staff and operational support for the CoEE program are provided by the Commission on Higher Education, which also approves the program annual operating budget.

Once a CoEE is approved by the Review Board, the fiscal lead institution, along with any collaborating institutions, has 18 months during which to solicit dollar-for-dollar, non-state pledges to match the state award total (between $2 million and $5 million). (In February 2007, the CoEE Review Board approved a policy whereby an institution may apply for as many as two, six-month extensions beyond the 18-month pledge verification deadline.) All non-state matching pledges must be realized within 78 months of the CoEE award date. State funds may only be drawn against in-hand (realized) non-state pledges. The entire portion of the state award, plus no less than 40% of the non-state match, must be placed into endowment for each CoEE; no more than 60% of the non-state match may be used to fund startup operating costs for a CoEE.

By the end of fiscal year (FY) 2007, the CoEE Review Board had approved 34 research centers[1] and 61 endowed chair positions, 11 of which were appointed by the end of FY 2007. [An additional eight chairs have been appointed in FY 2008.] As intended, the program is brightening the economic landscape in South Carolina: At the end of FY 2007, of the $144 million awarded by the Review Board, $89 million in non-state matches had been pledged, with more than $62 million in pledges realized and $52.6 million in state funds drawn down by the three senior research institutions.

Over time, each institution has developed concentrated CoEE focus areas. Clemson University's core strengths are in automotive and transportation technology, as well as in advanced materials and biotechnology/biomedical sciences. From 2003 to 2007, the CoEE Review Board awarded $46 million and 16 endowed professorships to Clemson University:

- The Clemson University International Center for Automotive Research (CU-ICAR), a worldwide automotive/motor sports research and development campus, has four CoEE endowed chairs in the fields of **Automotive Design and Development**, **Automotive Manufacturing**, **Automotive Systems Integration**, and **Electronic Systems Integration**.
- Research at the **Photonic Materials CoEE** concentrates on organic and inorganic materials for optical fiber and related photonic technologies.
- The **Advanced Fiber-Based Materials CoEE** researches novel fiber materials, fabrics, and integrated components which possess unique functionality and performance over traditional textile materials.
- The **Supply Chain Optimization & Logistics CoEE** focuses on supply chain modeling, material handling, logistics, planning systems, and distribution.

[1] The awards for the Restoration CoEE and Electron Imaging CoEE, totaling $8 million, were withdrawn by Clemson during FY 2008. These funds returned to the Centers of Excellence Matching Endowment for awarding during the 2007-2008 proposal cycle.

- The **Urban Ecology & Restoration CoEE** supports the growth of the state's environmental industry through the integration of basic ecological science with engineering and urban design.
- The goal of the **Molecular Nutrition CoEE** is to become the foremost center of scientific information on energy balance and the development and treatment of obesity.
- The **Health Facilities Design and Testing CoEE**, a collaboration between Clemson and MUSC (with Clemson as lead institution), researches the relationships between the design of health care settings, human health and health care delivery.
- Clemson also has an endowed chair as a collaborating institution in each of the following CoEEs: **Clinical Effectiveness and Patient Safety, Regenerative Medicine**, and **SeniorSMART™ Center**.
- The awards for the **Restoration CoEE** ($3 million, two chairs) and **Electron Imaging CoEE** ($5 million, one chair) were withdrawn by Clemson during FY 2008.

MUSC's focus areas are neuroscience, cancer research, cardiovascular disease, health care, and novel technologies. From 2003 to 2007, the CoEE Review Board awarded $55.5 million to MUSC to establish 12 CoEEs. All told, 25 CoEE endowed chairs were created to serve at MUSC:

- The **Proteomics CoEE** pursues research in new and improved technologies for studying and gathering information encoded in the genomes of proteins.
- The **Marine Genomics CoEE**, a collaboration between MUSC and the College of Charleston (with MUSC as the lead institution), researches marine functional genomics and bioinformatics, including the analysis of physiological adjustments in animal and plant genetics that result from environmental changes.
- The **Regenerative Medicine CoEE**, a collaboration between all three research institutions (with MUSC as the lead institution), expands statewide expertise in developmental biology, adult stem cell technology, and tissue engineering.

- The **Neuroscience CoEE** researches age-related neurodegenerative problems including dementia, Alzheimer's disease, Parkinson's disease, and stroke.
- The **Translational Cancer Therapeutics CoEE**, a collaboration between MUSC and USC (with MUSC as the lead institution), expands opportunities for increased interdisciplinary research to enhance research in the biology common to cancer.
- The **Cancer Drug Discovery CoEE**, a collaboration between MUSC and USC (with MUSC as the lead institution), provides mechanisms for target identification and generation of lead compounds in the drug discovery process.
- The **Gastrointestinal Cancer Diagnostics CoEE** researches state-of-the-art translational medicine for gastrointestinal cancer patients, with the eventual goal of decreasing the overall impact of cancer mortality and morbidity.
- The **Vision Science CoEE**, a collaboration between MUSC and USC (with MUSC as the lead institution), focuses on the development of new therapies for macular degeneration, glaucoma, retinitis pigmentosa, and other eye diseases.
- The **Molecular Proteomics in Cardiovascular Disease and Prevention CoEE** works to translate advances in basic bench science into clinical bedside care in an effort to improve cardiovascular prevention and treatment.
- The **Clinical Effectiveness & Patient Safety CoEE**, a collaboration between all three research institutions (with MUSC as the lead institution), improves clinical education and patient safety through the use of simulation technology.
- The **Tobacco-Related Malignancy CoEE** works to discover biomarkers of tobacco-related malignancies, with an initial focus on lung cancer.
- The **Stroke CoEE,** collaboration between MUSC and USC, strengthens the clinical and basic stroke research in South Carolina by stimulating the development of new therapeutics, emphasizing drug discovery and biotechnology.
- MUSC also has endowed chairs as a collaborating institution in the following four CoEEs: **Health Facilities Design & Testing** (one chair), **Brain Imaging** (two chairs), and **Childhood Neurotherapeutics** (one chair), and **Health Care Quality** (one chair).

USC has developed three major CoEE clusters: future fuels (including hydrogen and solid oxide fuel cell research), biomedical science, and nanotechnology. In the first four years of the program, USC received $50.5 million for the creation of 23 CoEE endowed chairs:

- The **Nanostructures CoEE** concentrates on research in experimental nanoscale physics and is positioning the state to compete in the global electronic technology market.
- The **Brain Imaging CoEE**, a collaboration between USC and MUSC (with USC as the lead institution), is a world-class brain imaging center which researches detection deception and minimally invasive brain stimulation technologies.
- The **Polymer Nanocomposites CoEE** conducts research on the development of new materials with improved properties for the polymers market.
- The **Travel and Tourism Technology CoEE**, a collaboration between USC and Coastal Carolina University (with USC as the lead institution), creates innovation in the tourism industry with new technological standards that will allow major tourism businesses to operate more efficiently.
- The Future Fuels Initiative, which is expanding USC's expertise in fuel cells and alternative energy, incorporates CoEE endowed chairs in **Hydrogen and Fuel Cell Economy**, **Renewable Fuel Cells** and **Solid Oxide Fuel Cells**.
- The **Childhood Neurotherapeutics CoEE**, a collaboration between USC and MUSC (with USC as the lead institution), uses advances in metabolic disorders, pharmacogenetics, and neuroinflammatory diseases to study neurological disorders in children.
- The **Health Care Quality CoEE**, a collaboration between USC, MUSC and Clemson (with USC as the lead institution), researches the national health care crisis and seeks to improve the quality and economics of South Carolina's health care systems.
- The **Rehabilitation and Reconstruction Sciences CoEE** is focused on medical and public health needs in the areas of orthopedic disorders, exercise and sports-related injury prevention, treatment and rehabilitation.

- The **Strategic Approaches to Electricity Production from Coal CoEE** focuses on the synthesis, characterization and testing of novel catalysts and adsorbents with applications in the power generation industry.
- The **SeniorSMART™ CoEE**, a collaboration between USC and Clemson (with USC as the lead agent), fosters multidisciplinary research that contributes to development of new jobs, products, and cutting-edge technologies to foster independence for seniors.
- USC also has an endowed chair as a collaborating institution in the following six CoEEs: **Clinical Effectiveness and Patient Safety, Regenerative Medicine, Translational Cancer Therapeutics, Cancer Drug Discovery, Vision Science,** and **Stroke.**

ECONOMIC IMPACT SUMMARY

After five years, the state's research institutions are fulfilling the Research Centers of Economic Excellence Act mandate to enhance the state's economy, recruit non-state dollars, and create well-paying jobs. Below follows a list of economic impact highlights that have resulted from the groundbreaking research being conducted by the Centers of Economic Excellence and the world-class scientists who lead them:[2]

Technology Transfer Data:

- The **Nanostructures CoEE** has filed three invention disclosures in the areas of nanomanufacturing and chemical and bio-molecular sensors.
- The **Brain Imaging CoEE** has presented 6 invention disclosures, has filed 3 U.S. provisional patent applications, 3 non-provisional U.S. patent applications and 1 international patent application.
- The **Proteomics CoEE** has obtained a U.S. patent for *Electrospray Ionization from Pointed Fibers.* This CoEE also has 9 invention disclosures, 4 U.S. provisional patent applications and 3 U.S. non-provisional patent applications.
- The **Marine Genomics CoEE** has registered 8 invention disclosures; filed 6 U.S. provisional patent applications, 5 non-provisional U.S. patent applications and 5 international patent applications; and licensed technology which has yielded $145,000 in revenue.
- The **Photonics Materals CoEE** has registered 8 invention disclosures, applied for 1 U.S. non-provisional patent and received 3 U.S. patents. The CoEE also has licensed income of $43,500 as a result of 2 license agreements.
- The **CoEE in Polymer Nanocomposites** has filed 2 U.S. non-provisional patent applications and 1 international patent application.
- The **Hydrogen and Fuel Cell Economy CoEE** and the **Renewable Fuels for Fuel Cell Economy CoEE** have registered 8 invention disclosures, filed 10 U.S. provisional patent applications along with 2 non-provisional U.S. patent applications and 2 international patent applications. One U.S. patent, *Method and System for Improving the Performance of a Fuel Cell*, has been issued.

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[2] For a comprehensive list of CoEE technology transfer data, see pp. 55-72 of the *Report*.

- The **Vision Science CoEE** has registered 2 invention disclosures.
- The **Gastrointestinal Cancer Diagnostics CoEE** registered 12 invention disclosures, 5 U.S. provisional patent applications, 4 U.S. non-provisional patent applications and 2 international patent applications.
- The **Cancer Drug Discovery CoEE** has registered 3 invention disclosures, 3 U.S. provisional patent applications and 1 U.S. non-provisional patent application.
- The **CoEE in Childhood Neurotherapeutics** registered 8 invention disclosures, 4 provisional U.S. patent applications, 6 U.S. non-provisional patent applications along with 10 international patent applications. Two patents have been issued. Four active licenses have yielded $25,000 in license income.
- The **CoEE in Molecular Proteomics** has registered 3 invention disclosures, 2 U.S. provisional patent applications, 2 U.S. non-provisional patent applications and 2 international patent applications. The CoEE has 2 active licenses for the detection of cardiovascular diseases in humans.

Industrial Consortiums:

- **CU-ICAR** and its **three CoEE chair-holders** are establishing the Clemson Vehicular Electronics Consortium to provide companies access to automotive research.
- The **Hydrogen and Fuel Cell CoEE** is part of USC's NSF Industry/University Cooperative Research Center for Fuel Cells, the only such center in the nation. Dues-paying members include BASF, General Motors and Eastman Chemical.
- The **Polymer Nanocomposites CoEE** is developing a precompetitive research consortium to study the uses of nanomaterials to improve polyester polymer performance.
- The **Neurosciences CoEE** participates in the Georgia/South Carolina Neuroscience Consortium.
- Clemson University has secured funding for the **Supply Chain Optimization & Logistics CoEE** from the National Science Foundation (NSF) for the creation of an Industry University Cooperative Research Center.

Increased Research Funding:

- The **Proteomics CoEE** is affiliated with the MUSC Proteomics Center, which recently received one of the largest competitive extramural research grants ever awarded in the state ($18.7 million).
- Dr. Kenneth Tew of the **Translational Cancer Therapeutics CoEE** has established a partnership with Novelos Pharmaceuticals, which has awarded a six-figure research grant to the CoEE which will be renewed in Fall 2007. Current federal funding for this Center totals over $450,000.
- The U.S. Air Force Research Laboratory has awarded the **Polymer Nanocomposites CoEE** a $901,000 grant.
- The **Nanostructures CoEE** has received $1.9 million in funding from a variety of sources, including NSF, Seagate Technology and the Army Research Office.
- The **three CoEE endowed chair teams of CU-ICAR** were awarded $1-plus million in grant funding in FY 2007 with pending proposals worth $6 million. In addition, CU-ICAR anticipates receiving $2.1 million in the next two years from a successful NIST Advanced Technology Program grant submitted by Michelin.
- Current federal funding for the **CoEE in Brain Imaging** exceeds $10 million.
- The **CoEE in Cancer Drug Discovery** had $3.7 million in sponsored federal funding for FY 2007.
- The **CoEE in Vision Science**, part of the larger Vision Research Center initiative at MUSC, obtained over $2.4 million in federal, corporate and foundational funding in FY 2007.
- The **CoEE in Molecular Proteomics in Cardiovascular Disease Prevention and Treatment** has received $950,000 from Ortho Clinical Diagnostics through a research contract.
- The **CoEE in Solid Oxide Fuel Cells** has received $500,000 in research funding from the Air Force Office of Scientific Research and Exxon Mobil/Yokohama.
- The **SeniorSMART™ CoEE** has garnered approximately $3.9 million in federal funding with $4.8 million in pending grant funding.

Corporate Relocation:

- Timken and BMW have located corporate research & development offices on the CU-ICAR campus. They have generated 400 high-paying jobs in the Upstate region.

Startup & Spin-off Companies:

- The **Regenerative Medicine CoEE** has launched a spin-off company, FirstString, which markets wound repair technology.
- Cephos Corporation, a spin-off company of the **Brain Imaging CoEE**, uses brain imaging technology to detect deception.
- The **Neurosciences CoEE** has supported the creation of SemiAlloGen, Inc., a biotech startup company which develops therapeutics for neurodegenerative disorders and cancer.
- Work associated with the **CoEE in Hydrogen and Fuel Cell Economy** and the **CoEE in Renewable Fuels for the Fuel Cell Economy** has led to one startup company and six spin-off companies.
- The **CoEE in Childhood Neurotherapeutics** has led to the creation of ImmunoMod, a spin-off company which develops drugs for treatment of diabetes.
- The **Photonic Materials CoEE** has launched two spin-off companies: Advanced Photonic Crystals and Tetramer Technologies.

CONCLUSION

Since the beginning of the CoEE program, South Carolina's research institutions have realized the great potential of consortia research centers. Unprecedented scientific collaboration among Clemson, USC and MUSC has become a hallmark of the Endowed Chairs Program. More than one-third of the CoEEs are scientific partnerships between and among S.C. public institutions. Recruiting the world's finest researchers is no easy task, but by planning strategically for focused research clusters and committing to a unique spirit of institutional collaboration, CoEE Program stakeholders have made South Carolina an attractive working environment in the new "flat world," where knowledge is the principal currency. In the coming years, the Palmetto State is set to become a major landmark on the knowledge-based economy map, attracting businesses and entrepreneurs which will vitally enhance the state's economy and reposition the state for success in the new century.

I. Program Introduction and History

In 2002, the South Carolina General Assembly passed the South Carolina Research Centers of Economic Excellence Act (Act). The legislation designated $200 million through 2010[1] from the South Carolina Education Lottery to establish unique Centers of Economic Excellence at South Carolina's three senior research institutions: Clemson University, the University of South Carolina, and the Medical University of South Carolina. Each Center of Economic Excellence (CoEE) specializes in knowledge-based economy research in fields such as engineering, nanotechnology, biomedical science, and energy science which are designed to promote and enhance the state's economy and ultimately lead to higher per capita income through the creation of new, high-paying jobs.

The Act also created the CoEE Review Board, which provides program oversight. The Review Board is composed of nine members: three appointed by the Governor, three by the President Pro Tempore of the Senate, and three by the Speaker of the House of Representatives. Membership terms are three years, and individuals may serve three total terms. The three research university presidents serve as ex-officio, non-voting members of the Review Board. Staff and operational support for the Endowed Chairs Program are provided by the Commission on Higher Education (CHE). CHE approves the operational budget for the program.

The CoEE Review Board held its first meeting on October 17, 2002, at which time it approved formal bylaws. At the December 5, 2002, meeting, the Review Board approved Program *Guidelines* and *Request for Proposals 2002-2003*, which established a competitive, annual process whereby Centers of Economic Excellence and supporting endowed chairs are proposed by the research institutions and approved by the Review Board. The three-tier review process includes two rigorous scientific evaluations (a technical review and an onsite panel review), followed by the Review Board's analysis of the review findings and a formal vote on individual proposals.

[1] The General Assembly appropriated $30 million per year in the state budget for fiscal years 2003 through 2007.

"Each year, we evaluate our best and brightest ideas, develop business partnerships to support them, and hope to have our proposals receive the endorsement of national experts and the CoEE Review Board."

Dr. Harris Pastides
Vice President for Research & Health Sciences
University of South Carolina

Once a research center is approved by the Review Board, an institution has 18 months in which to solicit dollar-for-dollar, non-state[2] pledges to match the state award total (between $2 million-$5 million). These non-state matching pledges must be realized within 78 months of the award date. (In February 2007, the CoEE Review Board approved a policy whereby an institution may apply for as many as two, six-month extensions beyond the 18-month pledge verification deadline.) State funds may only be drawn against in-hand (realized) non-state pledges. The entire state award, plus no less than 40% of the non-state match, must be placed into endowment for each CoEE; no more than 60% of the non-state match may be used to fund operating costs for a CoEE.[3] The endowment pays the salaries or salary supplements of the world-class scientists (endowed chairs) recruited to lead each CoEE and also funds the purchase of equipment, laboratory construction, other faculty and research assistants.

Since the onset of the CoEE program, the CoEE Review Board has worked diligently to balance its oversight responsibilities with the mandate to enhance the state's knowledge-based economy. On August 30, 2004, the Review Board voted to limit the number of non-collaborative proposals to three per year, while continuing to allow an unlimited number of collaborative proposals. On June 29, 2005, the Review Board approved a marketing plan in order to disseminate program successes and enhance program visibility; one year later, on June 13, 2006, the Review Board secured the marketing services of the Clare Morris Agency.

On June 13, 2006, the Review Board approved an RFP to audit the program for fiscal years 2003 to 2010. On August 28, 2006, the Review Board contracted the services of Derrick, Stubbs and Stith, LLC, to conduct program audits. The 2003-2006 South Carolina Centers of Economic Excellence Program Audit was released on November 5, 2007. The Review Board was pleased to announce that the first four years of program activity received an unqualified audit with no

[2] Non-state matches may derive from private and federal sources.
[3] At the October 20, 2006, CoEE Review Board meeting, the Review Board voted to change this minimum figure from $2 million to 40% of the non-state match total.

major material findings. The 2007 CoEE Program Audit was released on September 8, 2008, and similarly received an unqualified audit with no major material findings.

On December 12, 2006, the CoEE Review Board convened a Cost Share Work Group. Financial representatives from all three research institutions, the Office of the State Treasurer, and Commission on Higher Education staff gathered to discuss accounting standards related to the South Carolina Research Centers of Economic Excellence Act. On February 26, 2007, the Review Board approved a Cost Share Accounting Policy, which contains specific guidelines for claiming and valuing in-kind matches.[4]

[On November 5, 2007, the CoEE Review Board approved the protocol for a summative program evaluation for the program's first six years (2003-2008), as required by the Program *Guidelines*. The evaluation will be published in December 2008.]

> **"The Review Panel again applauds the state of South Carolina for its vision in developing and implementing the Centers of Economic Excellence Program As the U.S moves into what the writer Thomas Friedman calls a "flat world," where knowledge is the principal currency, a state cannot make a better investment than in its research institutions. South Carolina has constructed a program that focuses state resources on strategic goals, exploits natural advantages, and leverages private funds Importantly, the process is well organized and relies on external reviewers to recommend particular proposals for funding."**
>
> **from the *2006-2007 CoEE Onsite Review Panel Report***

During the program's first five years, the Review Board approved 34 CoEEs and 61 endowed chair positions, 11 of which were appointed by the end of FY 2007. [An additional eight chairs have been appointed in FY 2008.] As intended, the program is brightening the economic landscape in South Carolina: Of the $144 million[5] awarded by the Review Board through FY 2007, $89 million (62%) in non-state matches have been pledged, with more than $62 million (43%) of these pledges realized and $52.6 million in state funds drawn down by the three senior research institutions.[6]

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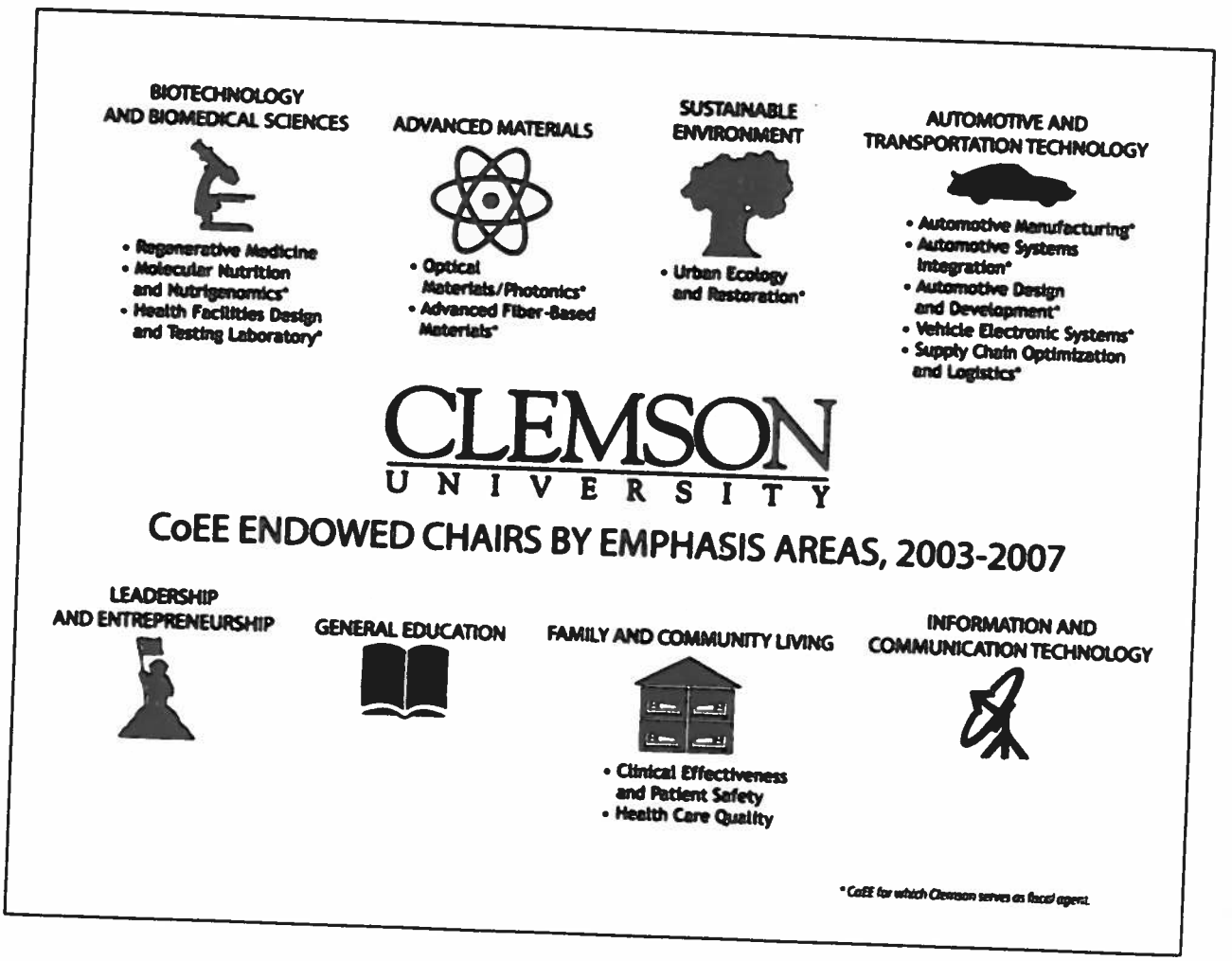
[4] The Cost Share Accounting Policy also applies to Research University Infrastructure Act projects, which is a separate statutory mandate of the CoEE Review Board.

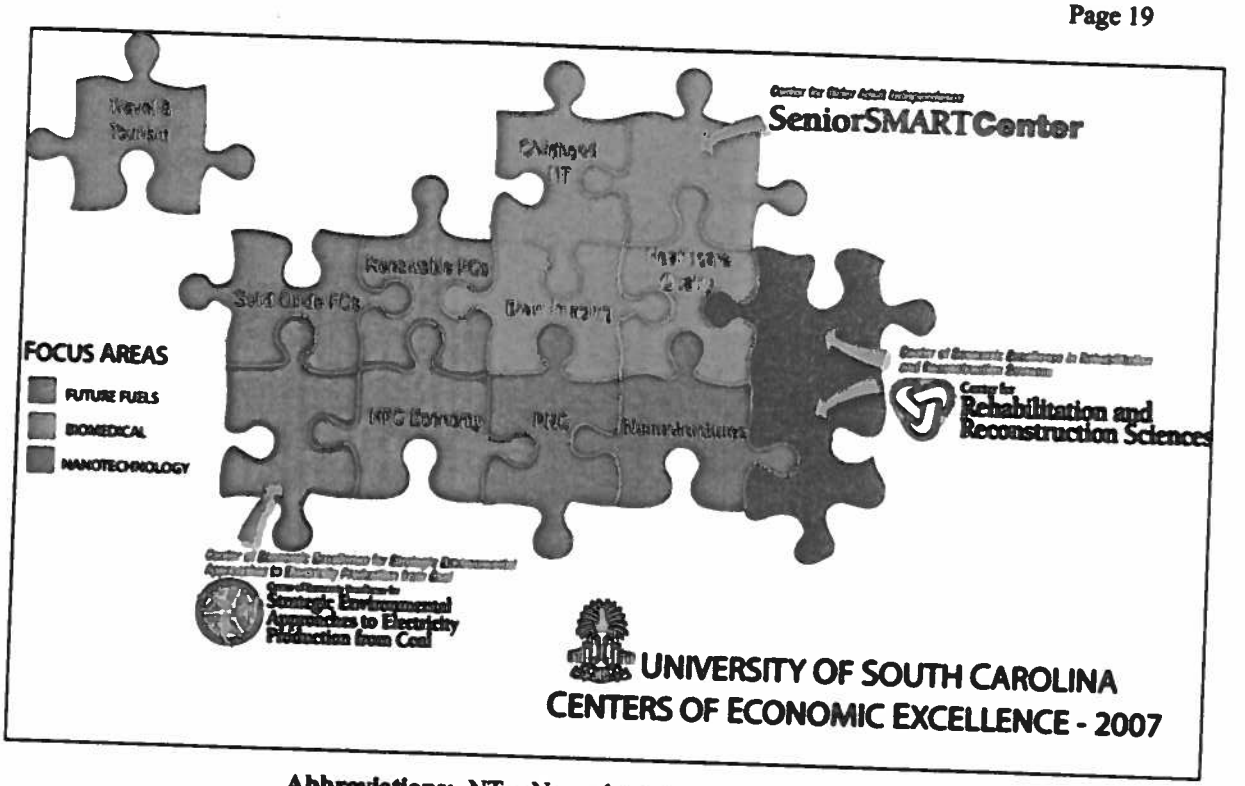
[5] The awards for the Restoration CoEE and Electron Imaging CoEE, totaling $8 million, were withdrawn by Clemson during FY 2008. These funds returned to the Centers of Excellence Matching Endowment for awarding during the 2007-2008 proposal cycle.

[6] As of April 30, 2008, these figures were $144 million awarded, $124 million (86%) match pledged, $71 million (49%) match received, and $61 million state funds drawn, respectively.

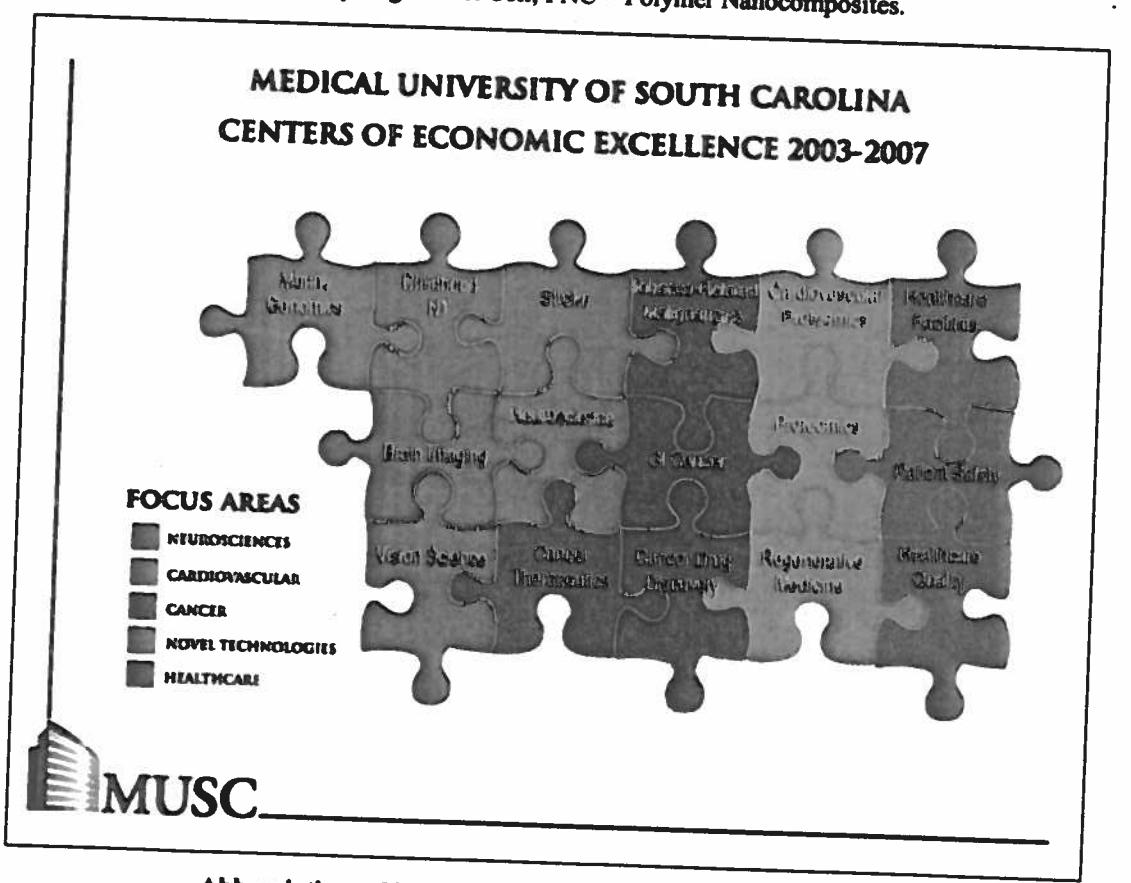
II. Strategic Planning and Collaboration

Over time, each research institution has developed concentrated CoEE focus areas. Clemson University's core strengths are in the area of automotive and transportation technology (with four CoEE endowed chairs at the Clemson University International Center for Automotive Research [CU-ICAR]), as well as in advanced materials development and biotechnology/biomedical sciences. USC has developed three major CoEE clusters: future fuels (including hydrogen and solid oxide fuel cell research), biomedical science, and nanotechnology. MUSC's strengths lie in the areas of neuroscience, cancer research, cardiovascular disease, healthcare, and novel technologies. The following graphic illustrations highlight the focus clusters at each of the three research institutions:





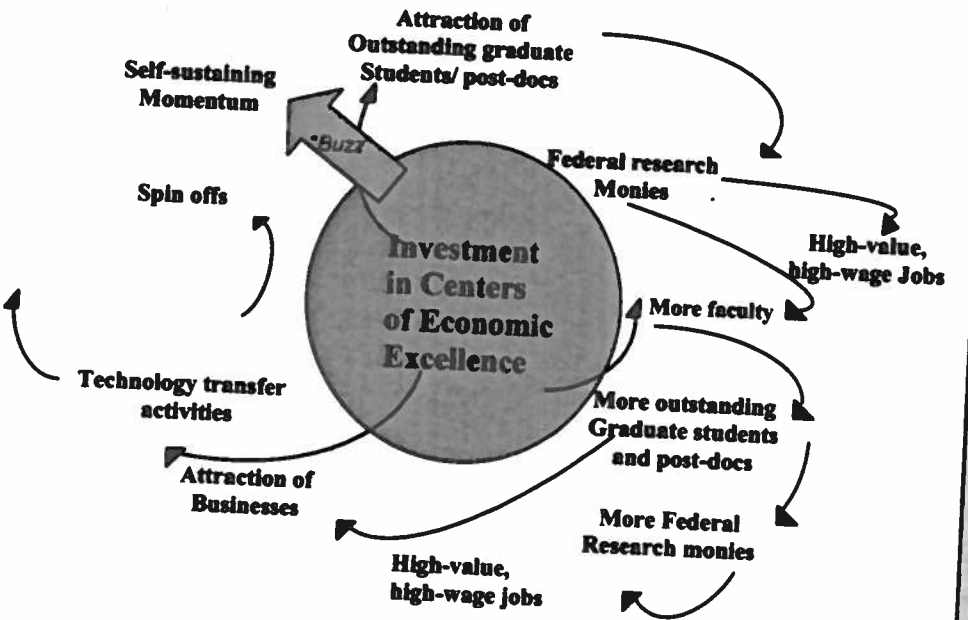
Abbreviations: NT = Neurotherapeutics; FC = Fuel Cells; HFC = Hydrogen Fuel Cell; PNC = Polymer Nanocomposites.



Abbreviations: NT = Neurotherapeutics; GI = Gastrointestinal.

The scientific discoveries and breakthroughs made by each CoEE will serve as a nucleus for industry and further research within the state, leading to a better and stronger knowledge base and economy. A prime example of the symbiotic strength of the CoEE Program is CU-ICAR, which potentially can support USC as a test facility for alternative fuel sources. USC's research in fuels can then be reinvested at CU-ICAR, where researchers are designing cars and trucks to best utilize future fuels. Research at Clemson and USC is thus likely to lead to economic development as automotive and energy companies are attracted to locate in South Carolina or to invest in research being conducted in the state: In December 2005, BMW opened its Information Technology Research Center, the first BMW R&D facility outside of the Munich area, on the CU-ICAR campus. The center houses approximately 180 personnel. In September 2006, Timken Corporation opened its Greenville Technology Center on the CU-ICAR campus; this facility employs 200 Timken workers and houses all of its product development activities for automotive applications, as well as the worldwide corporate center of excellence for dimensional and surface metrology and manufacturing process development. [In March 2008, Clemson also announced a partnership with Mazda North American Operations.] More than $220 million in private investment has entered the Upstate because of the CoEE Program and CU-ICAR.

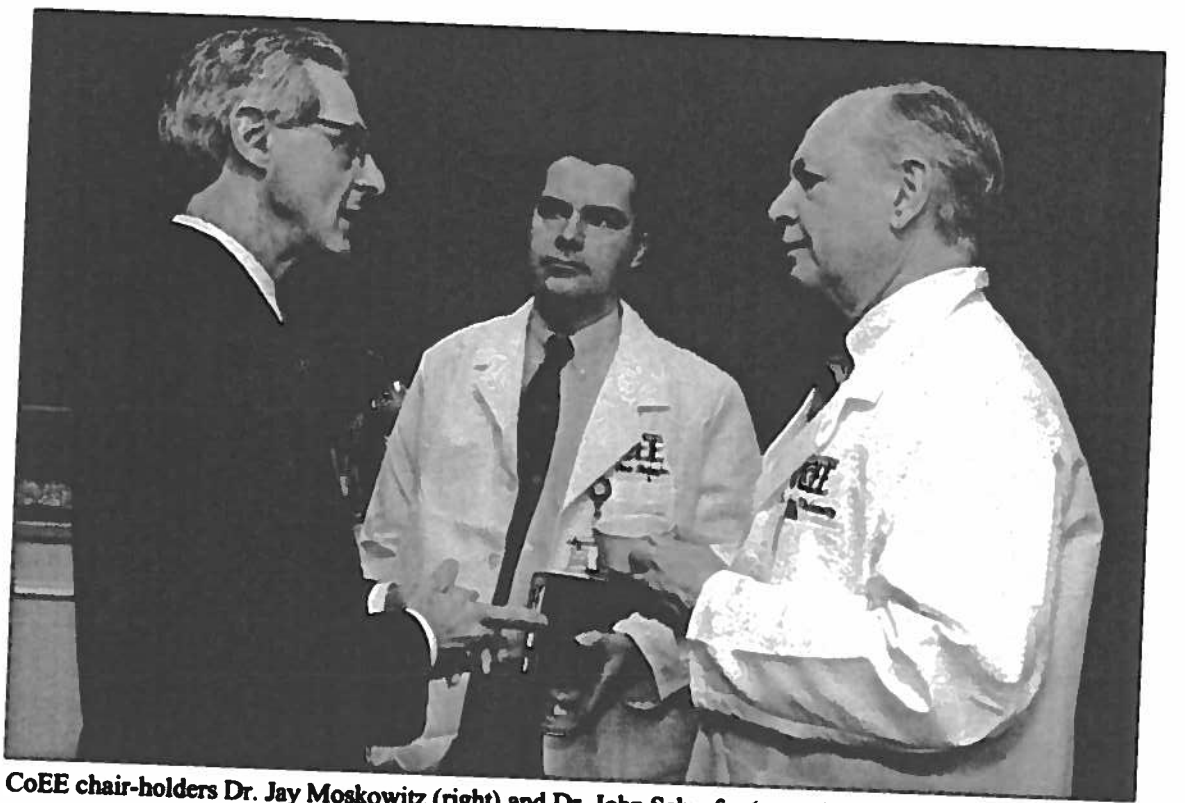
This cycle of economic development is shown in the following illustration:



"In the long term, the Centers of Economic Excellence Program, if sustained and complemented with other investments in education, should strengthen the perception of South Carolina as a place with an active role in the knowledge economy. This, in turn, will attract educated people to the state—including in areas not directly connected with the Research Centers—and also encourage more, and especially more of the best, graduates to stay."

from the *2006-2007 CoEE Onsite Review Panel Report*

Since the program's beginning, the research institutions have realized the great potential of collaboration and have pursued the creation of consortia research centers. More than one-third of the CoEEs are scientific partnerships between and among South Carolina public institutions, including two, four-year comprehensive teaching universities.[7] Dr. John Schaefer, endowed chair-holder at MUSC's CoEE in Clinical Effectiveness and Patient Safety, has noted that such academic collaboration rarely exists anywhere in the nation—not even at Harvard or Yale.

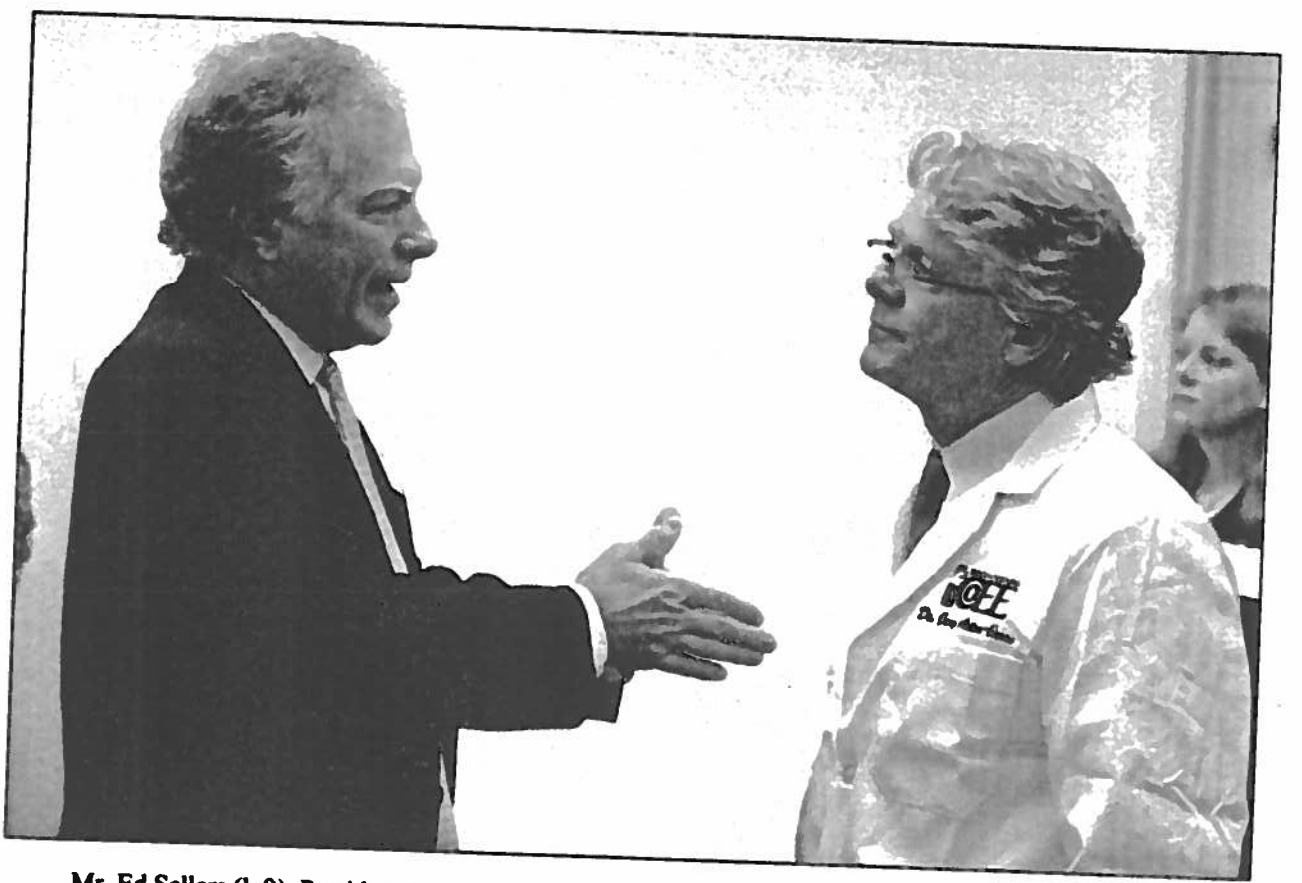


CoEE chair-holders Dr. Jay Moskowitz (right) and Dr. John Schaefer (center) discuss program collaboration with Dr. Donald DiPette (left), Dean of the USC School of Medicine.

In April 2004, Health Sciences South Carolina (HSSC) was established. HSSC is a statewide, public-private consortium of university and regional health systems with a shared vision of using health sciences research to improve the health and economic well-being of South Carolina. HSSC is a major non-state partner in nine health-related CoEEs. In August 2006, HSSC was the recipient of a $21 million grant from the Duke Endowment, the largest such grant by the Charlotte-based private foundation's health care division. A major portion of this grant is being used to match CoEE state awards.

[7] College of Charleston (CoEE in Marine Genomics) and Coastal Carolina University (CoEE in Travel & Tourism).

Dr. Jay Moskowitz, president of HSSC, is himself a CoEE endowed chair [appointed FY 2008] for the Health Care Quality CoEE. Dr. Moskowitz's vision for the Healthcare Quality CoEE is for doctors anywhere in the state to be able to access a patient's electronic medical records. He also spoke to the collaborative aspects of his work: "The Health Care Quality CoEE will examine safety, quality, cost efficiency, and bring healthcare teams together including doctors, nurses, scientists, and technicians. The next phase will be to bring in fiduciaries and the private sector into the mix of universities and hospital systems. And if this state achieves the highest quality and efficient healthcare system, it will, in the long run, lower healthcare costs in the state and at the same time bring in new industry and products from our healthcare systems. Then it will be a true success."



Mr. Ed Sellers (left), President and Chief Executive Officer of BlueCross BlueShield of South Carolina, and CoEE endowed chair-holder Dr. Gary Aston-Jones (right) of the Neuroscience CoEE. BlueCross BlueShield recently announced a major $5 million CoEE non-state donation and partnership.

The health sciences CoEEs are a prime example of the program's collaborative spirit. The Stroke CoEE is led by world-renowned neurologist and CoEE endowed chair-holder Dr. Robert Adams. Dr. Adams and his team are using telemedicine to link rural hospitals with stroke experts at MUSC. The program, called REACH, is already in place at three hospitals in the state: McLeod Health (Florence), Georgetown Memorial Hospital, and Waccamaw Hospital (Murrells Inlet). Soon Dr. Adams will extend virtual stroke care service across the entire state.

The CoEE in Clinical Effectiveness and Patient Safety, led by Dr. John Schaffer, is training healthcare personnel around the state so that medical errors are reduced. The first of three patient simulation training labs is already operating on the campus of the Greenville Hospital System, with a second training lab soon to follow at MUSC. Each lab is equipped with patient simulators, computerized mannequins that simulate human reactions. In FY 2007, over 450 medical personnel were trained in 150 simulation sessions in areas including emergency team training, difficult airway management, fiber-optic bronchoscopy, and labor and delivery skill application.

The SeniorSMART™ CoEE conducts multi-disciplinary research for the development of new jobs, products and cutting-edge technologies that foster independence for seniors. This CoEE consists of three endowed chairs. The two USC chairs are in Community & Social Support and Memory & Brain Function. The Clemson chair is in Driving, Mobility & Physical Functioning. Thanks to the collaboration of both institutions and a major non-state match from HSSC, SeniorSMART™ researchers are helping the elderly stay at home longer and enjoy a higher quality of life.

Driving simulator research is a key element of Clemson's SeniorSmart CoEE.

The appeal of bonded research partnerships serves as an enticing recruiting tool to the renowned scientists required to lead each Center. Dr. Richard Swaja, CoEE Chair in Regenerative Medicine at MUSC and a former senior advisor with the National Institutes of Health, has stated that he moved to South Carolina in part because of the state's recognition of the importance of collaboration and sharing resources.

The 2006-2007 CoEE Onsite Review Panel Report cited the uniqueness of the collaboration between the state's research institutions:

> "The Review Panel was very impressed with the level of collaboration among South Carolina's three research universities. As with institutional strategic planning, there is a high level of substantive activity that transcends the rhetoric typically encountered in most parts of the country....Particularly praiseworthy are the decisions to create a joint school of pharmacy between USC and MUSC and the creation of the Health Sciences South Carolina....Major initiatives of this kind, taken together with the array of activities in other areas of life sciences, travel/tourism, and more, suggests that the initials 'SC' could stand for 'Spirit of Collaboration' as well as South Carolina."

Recruiting the world's finest researchers is no easy task, but by strategically planning focused research clusters and committing to a unique spirit of institutional collaboration, the CoEE program stakeholders have made South Carolina a very attractive working environment in the new "flat world," where knowledge is the principal currency. In the coming years, South Carolina is likely to become a major mark on the knowledge economy map, attracting major businesses and research entrepreneurs which will vitally enhance the state's economy.

Mazda Senior VP Robert Davis (left) and Clemson's Dean of Engineering and Science Dr. Esin Gulari stand beside a Mazda CX-7 crossover SUV in the 7-post-shaker chamber at CU-ICAR.

III. Approved Centers of Economic Excellence: 2003-2007

Funding Year 2002-2003			
Institution (fiscal institution first)	**Proposal Title**	**Endowed Chairs**	**Proposal Amount**
Clemson	Automotive Systems Integration	1	$5 million
Clemson	Automotive Manufacturing	1	$5 million
USC	Nanostructures	1	$4 million
USC/MUSC	Brain Imaging	4	$5 million
MUSC	Proteomics	1	$4 million
MUSC	Neuroscience	3	$3 million
MUSC/College of Charleston	Marine Genomics	2	$4 million
Total Awarded in 2002-2003			**$30 million**

Funding Year 2003-2004			
Institution (fiscal institution first)	**Proposal Title**	**Endowed Chairs**	**Proposal Amount**
Clemson	Automotive Design & Development	1	$5 million
Clemson	Vehicle Electronic Systems Integration	1	$3 million
Clemson	Photonic Materials	1	$5 million
USC	Polymer Nanocomposites	1	$3.5 million
USC	Hydrogen & Fuel Cell Economy I *	2	$2.5 million
MUSC/Clemson/USC	Regenerative Medicine	3	$5 million
MUSC/USC	Translational Cancer Therapeutics	2	$5 million
Total Awarded in 2003-2004			**$29 million**

Funding Year 2004-2005			
Institution (fiscal institution first)	**Proposal Title**	**Endowed Chairs**	**Proposal Amount**
Clemson	Restoration [WITHDRAWN]	—	[$3 million]
Clemson	Electron Imaging [WITHDRAWN]	—	[$5 million]
USC	Renewable Fuel Cells	1	$3 million
USC	Hydrogen & Fuel Cell Economy II *	[See 03-04.]	$2.5 million
USC/Coastal Carolina	Travel & Tourism	1	$2 million
MUSC	Gastrointestinal Cancer Diagnostics	1	$5 million
MUSC/USC	Cancer Drug Discovery	4	$5 million
MUSC/USC	Vision Science	3	$4.5 million
Total Awarded in 2004-2005			**$22 million**

* The Hydrogen & Fuel Cell Economy CoEE was approved during 2003-2004. Funding for one half of this CoEE was provided in 2003-04, the other half in 2004-2005.

Funding Year 2005-2006			
Institution (fiscal institution first)	**Proposal Title**	**Endowed Chairs**	**Proposal Amount**
Clemson	Supply Chain Optimization & Logistics	1	$2 million
Clemson	Urban Ecology and Restoration	1	$2 million
Clemson	Advanced Fiber-Based Materials	1	$4 million
Clemson	Molecular Nutrition	1	$2 million
USC	Solid Oxide Fuel Cells	1	$3 million
USC/MUSC	Childhood Neurotherapeutics	3	$5 million
MUSC	Molecular Proteomics in Cardiovascular Disease & Prevention	2	$5 million
MUSC/USC/Clemson	Clinical Effectiveness & Patient Safety	3	$5 million
Total Awarded in 2005-2006			**$28 million**
Funding Year 2006-2007			
Institution (fiscal institution first)	**Proposal Title**	**Endowed Chairs**	**Proposal Amount**
Clemson/MUSC	Health Facilities Design & Testing	2	$5 million
USC	Rehabilitation and Reconstruction Science	1	$5 million
USC	Strategic Approaches to Electricity Production from Coal	1	$5 million
USC/MUSC/Clemson	Healthcare Quality	2	$5 million
USC/Clemson	Senior SMART™ Center †	3	$5 million
MUSC	Tobacco-Related Malignancy	2	$5 million
MUSC/USC	Stroke	3	$5 million
Total Awarded in 2006-2007			**$35 million**

† The SeniorSMART CoEE was approved in 2007-2008. Funding was provided from 2006-2007 dollars.

Program Totals	
Total Funds Awarded (2003-2007)	**$152 million**
CoEE Awards Withdrawn (during FY 2008)	**$8 million**
Proposal Funds to be Awarded June 9, 2008 (FY 2008)	**$36 million**
TOTAL LOTTERY APPROPRIATIONS (2003-2007)	**$180 million**

IV. Summary Descriptions of the Centers of Economic Excellence

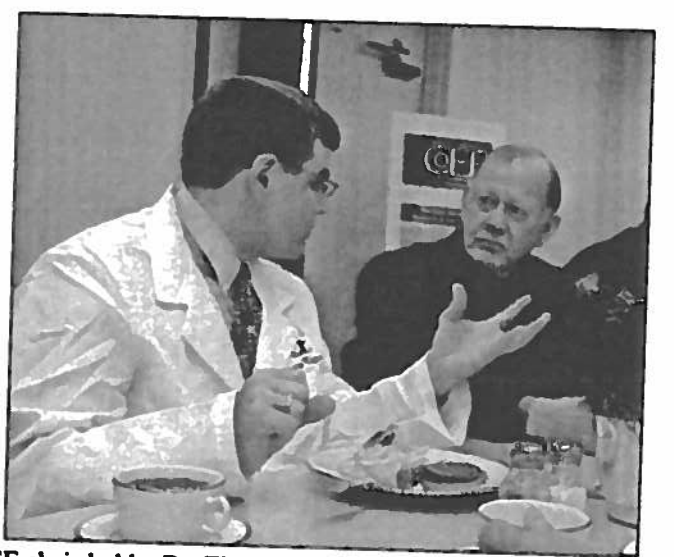
2002-2003 Centers of Economic Excellence

CoEE Endowed Chair Name: **Automotive Manufacturing**
Fiscal Institution: **Clemson University**

Award Date: 6/24/03
Award Amount: $5 million

The CoEE endowed chair in Automotive Manufacturing is working to develop novel micro-electromechanical systems technologies for manufacturing, as well as to improve the efficiency of manufacturing large, complex objects. This CoEE has contacted and/or is in discussion to develop private sector partnerships with such major companies as General Motors, IBM, Toyota, Honda, Daimler-Chrysler, Hewlett-Packard, Nissan, and Robert Bosch Corporation. Faculty-conducted workshops have been held with BMW, Michelin, Timken, and Siemens since 2004 to promote industry involvement in CU-ICAR's research initiatives. Two junior faculty members with expertise in production systems and quality assurance support this chair's research.

Dr. Thomas Kurfess, BMW CoEE ENDOWED CHAIR IN AUTOMOTIVE MANUFACTURING [appointed 8-15-05]. Kurfess' research focuses on precision systems, controls, auto-mation, and robotics. The results of his work are being used in a variety of manufacturing environments, helping U.S. companies to compete in the global market. In addition to automotive research, he is preparing the next generation of engineers to work in the complex global automotive industry. He is also director of the Carroll A. Campbell Jr. Graduate Engineering Center at CU-ICAR. Kurfess served as a special United Nations consultant to the government of Malaysia in the areas of applied mechatronics and manufacturing. He has received numerous honors and awards, including the National Science Foundation Young Investigator Award and a National Science Foundation Presidential Faculty Fellowship Award. In 2007, Kurfess delivered 40-plus presentations to corporations and civic groups. He is presently president of the Society of Manufacturing Engineers at the North American Manufacturing Research Institute as well as Associate Editor for the *International Journal of Engineering Education*.



CoEE chair-holder Dr. Thomas Kurfess (left) discusses the merits of the CoEE Program with S.C. Representative Lanny Littlejohn (right).

CoEE Endowed Name: **Automotive Systems Integration**
Fiscal Institution: **Clemson University**

Award Date: 6/24/03
Award Amount: $5 million

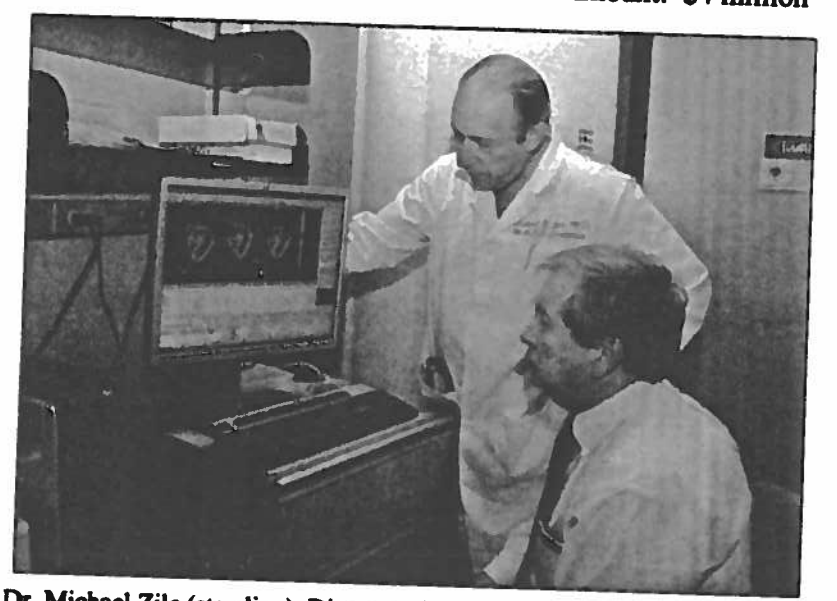
This CoEE chair is considered the linchpin of the CU-ICAR faculty positions—a person who will advance the field of integrated platform design, development, and manufacturing. Leaders at BMW and other major automotive companies have noted a lack of cultivation and education of systems integration engineers. (Systems integration is the testing of vehicle systems and their components to ensure efficient and safe operation.) This endowed chair-holder will have a proven track record of research in integrated platform design and manufacturing and a clear vision of the importance of this approach to future product design, development, and manufacturing. This chair will likely become a global leader, both as a researcher and instructor, in a field that is crucial to the global automotive market. BMW has committed itself as the major non-state partner of this endowed chair.

Clemson University is actively recruiting the CoEE CHAIR IN MECHANICAL ENGINEERING AND AUTOMOTIVE SYSTEMS INTEGRATION.

CoEE Name: **Proteomics**
Fiscal Institution: **Medical University of South Carolina**

Award Date: 6/24/03
Award Amount: $4 million

The Proteomics CoEE pursues research in new and improved technologies for studying and gathering information encoded in the genomes of proteins. Because of technology limitations, only limited protein information can currently be accessed and analyzed. However, the field of proteomics research is expected to lead to an understanding of cellular function at the molecular level, particularly how cellular functions go awry in disease. Thus, this CoEE is designed to yield patentable new technology and will provide visibility in the field of bioengineering which will attract industry. The MUSC Proteomics Center has been successful in obtaining a patent for electrospray ionization, which will hopefully soon lead to licensure. This CoEE has applied for a total of nine invention disclosures. The center was also the 2004 recipient of one of the largest competitive extramural research award ever received in the state ($18.7 million). In addition, a $500,000 NIH grant was secured in 2006 for the purchase of a mass spectrometer for tissue imaging research. In 2007, junior faculty member Dr. Lauren Ball received funding from the National Institutes of Health (NIH), the Department of Defense Breast Cancer Research Program, and the American Cancer Society.



Dr. Michael Zile (standing), Director of the Cardiovascular Proteomics CoEE, and Dr. Daniel Knapp (right), Director of the Proteomics CoEE , discuss applications of proteomic methods to unraveling the mechanisms of heart failure.

MUSC is actively recruiting the CoEE CHAIR IN PROTEOMICS.

CoEE Name: **Neuroscience**
Fiscal Institution: **Medical University of South Carolina**

Award Date: 6/24/03
Award Amount: $3 million

The Neuroscience CoEE researches age-related neurodegenerative problems including dementia, Alzheimer's disease, Parkinson's disease and stroke. This area of research has a major impact on South Carolina, where more than half of the population is over the age of 56. This CoEE is a strong component of MUSC's established Neuroscience Institute and also works in collaboration with the MUSC Center on Aging. Specifically, the endowed chair-holders for this CoEE will work to assist in the establishment of biotechnology companies in South Carolina. The CoEE has partnered with Cure Parkinson's Project, a non-profit corporation devoted to curing Parkinson's disease. This CoEE will continue MUSC's affiliations with companies including AstraZeneca, Pfizer, Janssen Pharmaceuticals and Merck. The CoEE has also supported the creation of SemiAlloGen, Inc., a biotechnology startup company which develops therapeutics in the field of neurodegenerative disorders and cancer. A CoEE project with Jazz Pharmaceuticals is in development to test mechanisms of action of the drug Xyrem. A medical device company Cyberonics, Inc. has supplied equipment worth $30,000 and consulting expertise in modulating cognitive processes to this CoEE's research efforts. In 2006-2007, CoEE chair-holders Dr. Aston-Jones and Dr. Miguel Pappolla produced 11 published works.

Dr. Miguel Pappolla, JOSEPHINE TUCKER MORSE COEE ENDOWED CHAIR IN NEUROSCIENCE [appointed 1-3-06]. Pappolla's research focus is on neuron-protective compounds used to fight the effects of aging and disease and to protect humans against the damaging effects of aging and diseases such as cancer, Alzheimer's disease, and cardiovascular disease. These compounds will likely have commercial applications in medical treatments and nutritional supplements, as well as in cosmetic creams and anti-aging makeup. Pappolla's research has generated two patents for neuron-protective compounds, with two patents pending. He has earned multiple grants from NIH, the U.S. Department of Veterans Affairs, and other foundations and corporations. Pappolla is currently developing a pain management clinic in conjunction with the MUSC Department of Neurosciences which will lay the platform for translational pain research.


CoEE chair Dr. Gary Aston-Jones

Dr. Gary Aston-Jones, WILLIAM H. MURRAY COEE ENDOWED CHAIR IN NEUROPATHOLOGY [appointed 7-1-06]. Aston-Jones' research focus is motivation and cognitive processes. The influence of motivation on cognitive processes is at the center of his work, with particular emphasis on patient focus (the ability to concentrate and disengage on tasks) in certain mental disorders. Aston-Jones' research has led to a new drug treatment for ADD. His other work has applications for better determining the specific processes involved in learning and dementia. Aston-Jones previously served at the University of Pennsylvania. He has received continuous NIH funding since 1983. In 2007, Aston-Jones was a featured speaker at the Okinawa Institute of Science Workshop on Cognitive Neurobiology and at the 11th International Conference on Cognitive and Neural Systems.

[MUSC recently announced the FY 2008 appointment of Dr. Marc Chimowitz as the COEE CHAIR IN MOVEMENT DISORDERS.]

"The Centers of Economic Excellence program is a critical tool in our efforts to build South Carolina's life sciences sector. MUSC now boasts eleven highly respected CoEE professors working to develop new health technologies to improve patient care. Without the program, it would have been extremely difficult to recruit these talented individuals."

President Raymond S. Greenberg
Medical University of South Carolina

CoEE Name: **Marine Genomics**
Fiscal Institution: **Medical University of South Carolina**
Collaborative Institution: **College of Charleston**

Award Date: 6/24/03
Award Amount: $4 million

The Applied Marine Genomics CoEE researches marine functional genomics and bioinformatics, which includes analyzing physiological adjustments in animal and plant genetics that result from environmental changes. This CoEE also uses genomics tools to render aquatic species with increased resistance to disease and infection, as well as develops technology to enable rapid detection of pathogens. Genomics technology is an important tool for the South Carolina oyster and shrimp business. The CoEE's investors and collaborators include Hollings Marine Laboratory, the National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service, and the S.C. Department of Natural Resources. This CoEE sells diagnostic gene chips to the International Oyster Microarray Consortium on a cost-recovery basis, raising the profile of the marine genomics group in the international community. As a international leader in this field, the CoEE has established the world's only data and tools-based marine genomics website. In 2007, the CoEE generated intellectual property based on a major discovery relating to RNA and viral infections in shrimp. Commercial opportunity is very viable if an effective pathway of RNA delivery can be developed. The CoEE has partnered with two private companies, Shrimp Improvement Systems and Biogenmar, and is negotiating a formal relationship with a third company, Martec, in order to translate intellectual property into licenses, products and jobs in the aquaculture and bioscience areas. The CoEE is in discussion with Chugai Pharmaceutical Company about the development of marine pharmaceuticals using microbial genomics technology. Other contract partners include the University of Delaware and the National Institute of Standards and Technology.

MUSC is in negotiation for the CoEE CHAIR IN MARINE BIOINFORMATICS and is actively recruiting the CoEE CHAIR IN MARINE GENOMICS.

"The program has given South Carolina's research universities the wherewithal to recruit world-class scientists who will lead economic development in the state. New innovations generated by the program will yield a great return on investment."

Dr. John Raymond
Provost and Vice President for Academic Affairs
Medical University of South Carolina

CoEE Name: **Brain Imaging**
Fiscal Institution: **University of South Carolina**
Collaborative Institution: **Medical University of South Carolina**

Award Date: 6/24/03
Award Amount: $5 million

The Brain Imaging CoEE combines expertise at USC and MUSC to create a world-class brain imaging center. This collaborative CoEE anticipates receiving federal grants and contracts and is likely to spawn startup companies in the areas of deception detection and minimally invasive brain stimulation technologies. Current federal funding is in excess of $10 million and a Department of Defense proposal regarding the study of traumatic brain injury in combat troops is currently being submitted for $37 million. The CoEE launched a spin-off company, Cephos Corporation, which uses brain imaging technology to detect deception. Cephos has opened a small Charleston office and expects to market its technology in Spring 2008. The Brain Imaging CoEE continues to work with Philips Research S ientists, which has decided to launch a research initiative in brain imaging and stimulation A partnership has also been formed with Ladson-based Force Protection Industries (FPI), a major Charleston area employer. A leading manufacturer of tanks and armored vehicles, FPI will utilize CoEE research in the prevention of traumatic brain injury due to combat explosions. Two recently acquired MRI systems, a Siemens Trio MRI system and a Bruker 7-Tesla, are attracting important companies such as Glaxo-Smith Kline, Jazz Pharmaceuticals and BioValve, which use the systems to speed drug discovery and development in mood stabilizers, anticonvulsants, and cognitive enhancers The CoEE-launched facility, McCausland Imaging Center, located in the Palmetto Richland Hospital, includes dedicated research space and scanner time, allowing scientists to conduct research with neurologically healthy individuals as well as clinical populations Most recently, the CoEE has launched the Center for Animal Imaging which uses a Bruker 7-Tesla small bore MRI system, allowing translational research in substance abuse and epilepsy therapy

USC is negotiating final contracts for both the CoEE CHAIR IN COGNITIVE NEUROIMAGING.

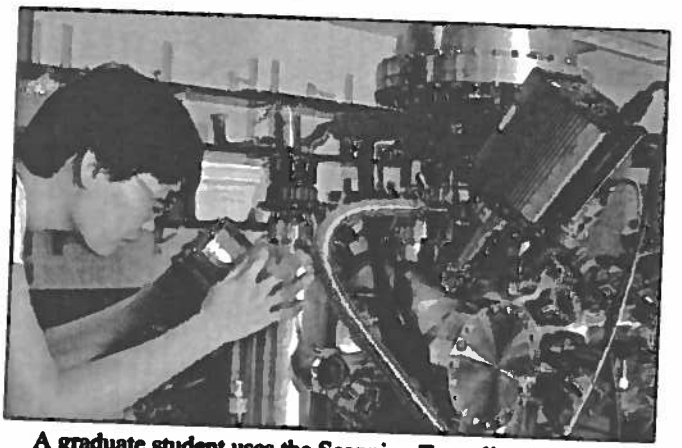
[MUSC recently announced the FY 2008 appointment of Dr. Paul Simon Morgan as the CoEE CHAIR IN BRAIN IMAGING.]

[The Brain Imaging CoEE proposal was revised by the CoEE Review Board on June 9, 2008, reducing the number of awarded chairs from four to two.]

Dr. Michael Schillaci, Director of the Brain Imaging CoEE McCausland Brain Imaging Center, views the results of anatomical and functional scans produced on the Siemens Magnetom Trio Magnetic Resonance Imaging System.

CoEE Name: **Nanostructures**
Fiscal Institution: **University of South Carolina**

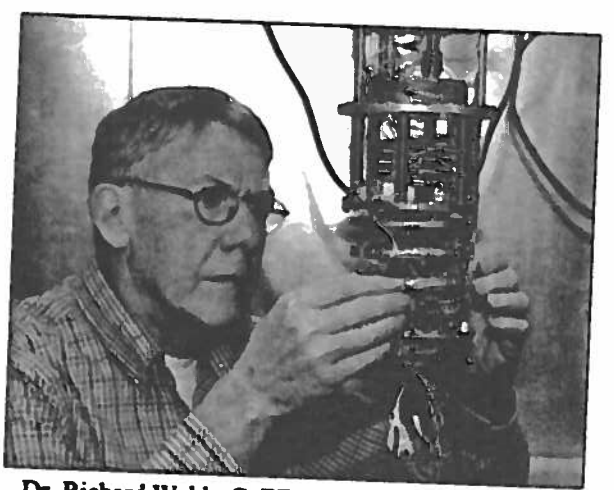
Award Date: 6/24/03
Award Amount: $4 million



A graduate student uses the Scanning Tunneling Microscope to study nanostructures in the surface chemistry laboratory.

The Nanostructures CoEE is a component of the USC Nanocenter. This CoEE concentrates on research in experimental nanoscale physics and is positioning the state to compete in the global future electronics market. The program has five major focus areas: (a) synthesis/characterization of nanowires in metals and semiconductors for novel magnetism in electronic circuits; (b) development of high power LEDs, transistors, and optoelectric properties of materials; (c) development of nano-magnetics, high frequency switching, and spintronics; (d) development of novel superconducting states/materials; and (e) discovery of novel concepts for nanoscale sensors for magnetic and structural properties. Currently this CoEE is attempting to develop better and cheaper hydrogen gas sensors and multi-dimensional detection and analysis systems. The CoEE has received $1.6 million in combined funding from the National Science Foundation (NSF), the Army Research Office, Seagate Technology and Aerotech Corporation. Through the partnership with Seagate Research, the CoEE is studying fabricated samples to aid in characterizing materials used in the disk drive industry. Two assistant professors with expertise in condensed matter physics and theoretical physics were hired in 2005-2006 with a third professor expected to be hired in Fall 2007.

Dr. Richard Webb, CoEE Chair in Nano-electronics [appointed 8-16-04]. Webb is researching quantum devices for use in computer electronics and information technology. His scientific accomplishments include fabricating some of the world's smallest electronic circuits, which could pioneer the development of smaller, higher-performing electronic devices. Current products based on Webb's discoveries include sensors which diagnose heart problems and monitor internal faults in metal structures. Previously, Webb managed the quantum electronics program at IBM's T.J. Watson Laboratory. He is a member of the National Academy of Sciences (one of only two USC researchers to hold that distinction) and is a fellow of the American Academy of Arts and Sciences.



Dr. Richard Webb, CoEE Chair in Nanoelectronics

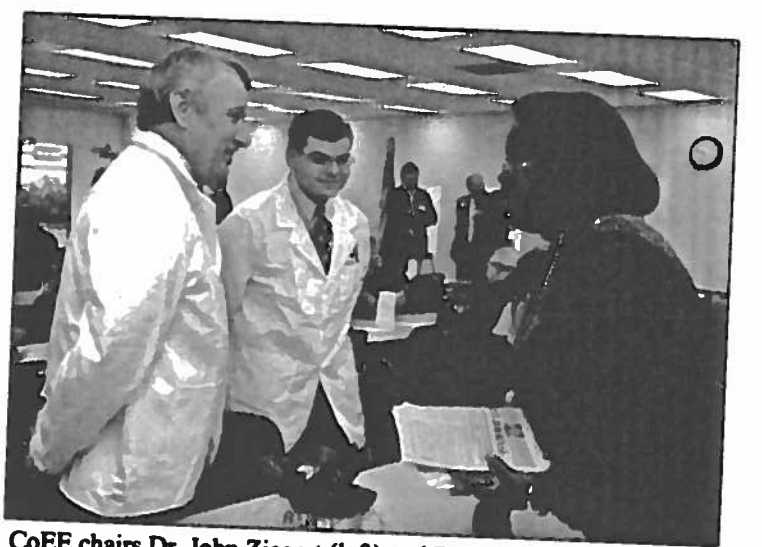
SOUTH CAROLINA CoEE

2003-2004 Centers of Economic Excellence

CoEE Endowed Chair Name: **Automotive Design & Development** Award Date: 8/25/03
Fiscal Institution: **Clemson University** Award Amount: $5 million

The CoEE endowed chair in Automotive Design & Development is part of the Clemson University International Center for Automotive Research (CU-ICAR), a worldwide automotive/motor sports research and development campus with more than $220 million in public and private investment to date. This CoEE endowed chair researches and advances the fields of vehicular design and development, methodologies, and design tools. Non-state funding for this CoEE has been secured with the Timken Company (Fortune 500), which is well-known for providing automotive industry products and solutions based on friction management and power transmission. Timken opened its new Greenville Technology Center (GTC) in September 2006 on the CU-ICAR campus. GTC houses Timken's product development activities for automotive applications and its worldwide corporate center of excellence for dimensional and surface metrology and manufacturing process development. Approximately 200 Timken employees work in this facility. Timken furthered its partnership with the donation of approximately $800,000 worth of equipment for the Campbell Graduate Engineering Center, which is currently under construction [see page 35].

Dr. John Ziegert, TIMKEN COEE ENDOWED CHAIR IN AUTOMOTIVE DESIGN AND DEVELOPMENT [appointed 8-15-06]. Ziegert's research is focused on designing automotive instruments and machines used in high-precision measurement and manufacturing. At CU-ICAR, Ziegert and his team are developing friction management and power transmission solutions that show promise for improving the manufacturing processes for a variety of industry sectors. He has held academic appointments at the University of Florida, the University of Hawaii, Brown University and the California Institute of Technology. He serves as president of Tetra Precision Inc., a Florida-based metrology company. Ziegert holds three patents with three more pending. During 2007, he delivered multiple national and international presentations including addresses for the Automation 2007 Conference in Taiwan, the North American Tire Conference, and the first International Conference on Micro-manufacturing. Ziegert serves as editor-in-chief for *Precision Engineering* and is the organizing chair for the International Conference on Micromanufacturing.



CoEE chairs Dr. John Ziegert (left) and Dr. Thomas Kurfess (center) discuss research at CU-ICAR with S.C. Rep. Gilda Cobb-Hunter (right).

CoEE Endowed Chair Name: **Vehicle Electronic Systems Integration** Award Date: 4/27/04
Fiscal Institution: **Clemson University** Award Amount: $3 million

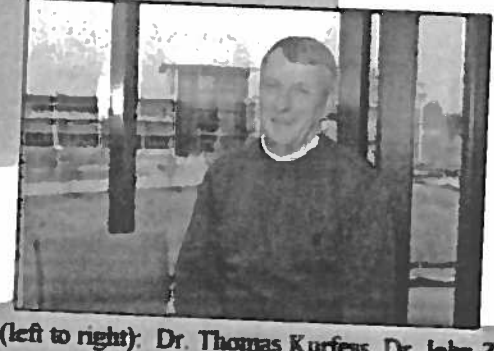
The CoEE endowed chair in Vehicle Electronic Systems Integration at CU-ICAR researches vehicle electronics, a complex field where components such as software, telematics, information and communication systems, electronics, mechatronics, and sensors must be integrated in a well-balanced way to create attractive, stable, economic products. In automotive technology, electronics is the area with the greatest promise for growth, and South Carolina has the potential to become a major R&D center in vehicular electronics through the research conducted by this chair. The Clemson Vehicular Electronics Consortium has been created, which provides companies access to the automotive research at CU-ICAR. Already, several companies have expressed interest in joining the consortium. Funding is being pursued for an anechoic chamber and facilities to accommodate this system. This facility will provide the only full-vehicle EMC test capability in the U.S. Southeast, which will save companies time and resources and attract new industry to the state. Michelin has made a full non-state match donation for this chair.

Clemson University's Michelin Endowed Chair in Vehicle Electronic Systems Integration
Dr. Todd Hubing (right) instructs a graduate student in the 7-post-shaker chamber at CU-ICAR.

Dr. Todd H. Hubing, MICHELIN COEE ENDOWED CHAIR IN VEHICLE ELECTRONIC SYSTEMS INTEGRATION [appointed 7-1-06]. Hubing's research focus is the electronic automotive systems industry, with particular emphasis on systems compatibility. His research has applications for the development of a more practical electric-powered car. Previously, Hubing was a professor of electrical and computer engineering at the University of Missouri-Rolla. In 2007, he made nine presentations, including to the IEEE International Symposium on Electromanetic Compatibility, the IEEE EMC Society in Tokyo, and the Freescale Technology Forum. Hubing serves in various leadership roles including the Board of Directors for the IEEE Electromagnetic Compatibility Society and the Scientific Committee for the EMC Europe Workshop 2007.

The Carroll A. Campbell Jr. Graduate Engineering Center at CU-ICAR

The Campbell Graduate Engineering Center on the CU-ICAR campus, which will house all four Clemson CoEE automotive endowed chairs and their research teams, is under construction and should be completed by June 2008. During FY 2007, Michelin received a National Institute of Standards and Technology (NIST) Advanced Technology Program Award with a budget portion for CU-ICAR for $2.1 million. Additionally, the CoEE chairs and their teams were awarded 16 grants from federal and corporate sources totaling more than $1 million, with seven pending proposals for nearly $6 million. CU-ICAR faculty recently completed the final design of the Automotive Engineering graduate school curriculum (for master's and doctoral degrees) and held its first classes in August 2007.



Current CoEE Chairs at CU-ICAR (left to right): Dr. Thomas Kurfess, Dr. John Ziegert and Dr. Todd Hubing.

CENTERS of ECONOMIC EXC

CoEE Endowed Chair Name: **Photonic Materials**
Fiscal Institution: **Clemson University**

Award Date: 4/27/04
Award Amount: $5 million

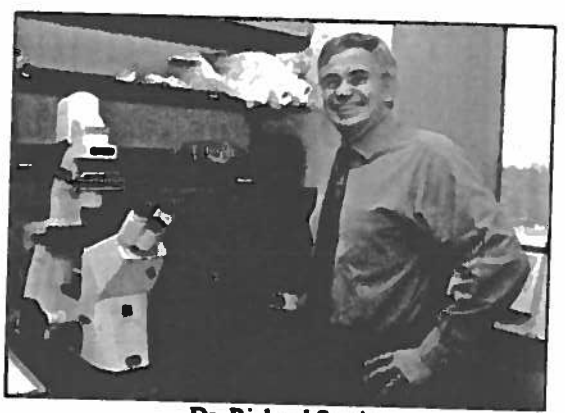
The Photonic Materials CoEE is closely affiliated with Clemson's Center for Optical Materials Science and Engineering Technologies (COMSET). (Since 2000, COMSET's sponsored research has exceeded $35 million.) The Photonic Materials CoEE chair will lead COMSET's research activities in organic and inorganic materials for optical fiber and related photonic technologies. (The science and engineering of light-based technologies is a $300 billion global market with projected growth to $1 trillion by 2015.) 3M Corporation recently donated a modified chemical deposition vapor system worth nearly $900,000 to this CoEE; Clemson is now one of only three universities in the world with industry-level optical fiber production capability. This CoEE focuses on the design, fabrication, and testing of optical fibers for use in (a) directed energy systems critical to federal defense efforts; (b) communication systems for automobiles and information technologies; and (c) light-based biomedical therapies. In 2005, the High Energy Laser Joint Technology Office awarded Clemson a $2.7 million research grant for light-based technology research. This CoEE has also received major funding from the J.E. Sirrine Textile Foundation. The Carolina MicroOptics Triangle (CMOT) is a regional optics cluster that brings together research and economic development between Clemson, UNC-Charlotte and Western Carolina University. CMOT added industrial affiliates in 2007 and is recognized as one of only four university photonics clusters in the U.S. Additionally, COMSET will formalize the Carolinas Photonics Consortium this upcoming year, adding Duke University and North Carolina State University to CMOT. The focus of these consortia is to advance the joint development of new optical materials, devices and components in support of the existing photonics industry in the Carolinas as well as the creation of new ventures. This CoEE has launched two spin-off companies: Advanced Photonic Crystals and Tetramer Technologies.

Clemson is recruiting the J. E. SIRRINE FOUNDATION ENDOWED CHAIR OF OPTICAL MATERIALS.

Industry quality glass being drawn into optical fiber at 4,000° F at Clemson University's Center for Optical Materials Science and Engineering Technologies (COMSET).

CoEE Name: **Regenerative Medicine**
Fiscal Institution: **Medical University of South Carolina** Award Date: 8/25/03
Collaborative Institutions: **Clemson University & University of South Carolina** Award Amount: $5 million

The Regenerative Medicine CoEE combines statewide expertise in developmental biology, adult stem cell technology and tissue engineering. Regenerative medicine is defined as the regeneration of tissue and organs for the purpose of repairing, replacing and maintaining organ function. The goals of this collaborative CoEE between all three research universities include: (a) fostering basic research in genetics, proteogenomics, developmental biology, cell biology, and physiology of stem cells; (b) translating basic research into novel therapies for genetic and degenerative disorders; (c) collaborating with the private sector to develop business innovation research grants that can lead to partnerships with the business community and the federal government; and (d) establishing pre-doctoral and postdoctoral training programs in stem cell technology, developmental biology, biomaterials, and tissue engineering. The most significant scientific accomplishments thus far for this CoEE are in the field of bioprinting, the assembly of living 3D human tissues and organs using rapid prototyping technology. In addition, advances in the multiple areas of bioengineering, wound healing, vascular biology, orthopedic materials science and cardiac development have led to an effort to construct a biofabricated blood vessel network. In 2006, MUSC faculty renewed a $10.8 million NIH Center of Biomedical Research Excellence Award for regenerative medicine research and received an Introductory Molecular Biology Research Experience NIH grant. A spin-off company, FirstString, was created in 2006 featuring new wound repair technology; it has garnered investments of more than $600,000, including the support of SC Launch! and the NIH Small Business Technology Transfer Program. FirstString is working on a wound-repair gel which has the potential to earn tens of millions of dollars.



Dr. Richard Swaja,
CoEE Chair in Regenerative Medicine.

Dr. Richard Swaja, CoEE Chair in Regenerative Medicine [appointed 10-1-06]. Swaja's research focus is regenerative medicine and tissue engineering. His current work focuses primarily on regenerative medicine—the application of tissue engineering principles to restore the structure and function of damaged tissues and organs. Swaja is also the director of the S.C. Bioengineering Alliance and is working to improve the state's bioengineering capabilities by developing a statewide research and education program to increase technology transfer between research institutions and S.C. companies. Swaja was previously a senior advisor for biomedical engineering with NIH. He has managed reseach programs at Oak Ridge National Laboratory and served as a U.S. representative to several national and international scientific committees for activities including bioengineering and environmental risk assessment. Swaja also holds professorships at Clemson and USC.

Clemson University is actively recruiting the CoEE Chair in Biomaterials.

[USC appointed Dr. Martin Morad as the CoEE Chair in Cardiac Molecular Imaging in March 2008.]

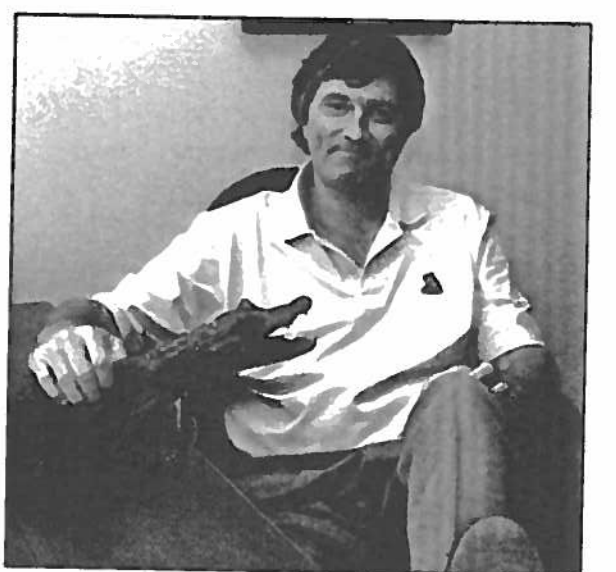
CoEE Name: **Translational Cancer Therapeutics**
Fiscal Institution: **Medical University of South Carolina**
Collaborative Institution: **University of South Carolina**

Award Date: 4/27/04
Award Amount: $5 million

The collaborative Translational Cancer Therapeutics CoEE builds on existing strengths in pharmacology at USC and MUSC and expands opportunities for increased interdisciplinary research to enhance scientific research in the biology common to cancer. As research builds in the discovery and development of cancer drugs, the state economy will be strengthened by biotechnology companies with pharmaceutical interests. Already the creation of this CoEE has led to the hiring of prominent scientists from the University of Virginia, NIH, Harvard University, and the Fox Chase Cancer Center. Novelos Pharmaceuticals has awarded this CoEE an unrestricted $220,000 grant to study lung and ovarian cancer. In addition, a Small Business Technology Transfer grant application was submitted to the National Cancer Institute. Current federal funding for this CoEE totals over $450,000. In March 2007, this CoEE co-hosted the Hollings Cancer Center Spring Symposium in Cancer Drug Discovery and Development, which was attended by a host of international pharmaceutical and medical experts and representatives. In 2007, this CoEE also supported the recruitment of three new assistant professors and an associate professor to MUSC. These four individuals from Harvard University, the Fox Chase Cancer Center, the University of Virginia and NIH have formed a drug discovery team under the direction of CoEE chair Dr. Kenneth Tew. During the past year, individuals associated with the CoEE have published four peer-reviewed manuscripts, five book chapters and three abstracts.

USC is finalizing the search for the CoEE CHAIR IN DRUG EFFICACY.

Dr. Kenneth Tew, JOHN C. WEST CHAIR IN CANCER RESEARCH [appointed 1-1-04]. Tew has an international reputation as a cancer drug discovery researcher and developer. His early research was pivotal in the design of treatment for hormone refractory prostate cancer. Tew's research has also proved instrumental in the late-stage clinical testing of two promising drugs, one for treating ovarian and lung cancer, and another that serves as a modifier of bone marrow-mediated immune function. Tew is presently conducting research on how cancer cells develop resistance to different drugs. Discoveries from this work have suggested links between cancer and Alzheimer's disease. Tew sits on scientific advisory boards of a number of pharmaceutical companies. He has been awarded a National Cancer Institute Outstanding Investigator Grant and an American Cancer Research Society (ACS) Scientific Excellence Award. He is also chair of MUSC's Department of Cell and Molecular Pharmacology and Experimental Therapeutics.



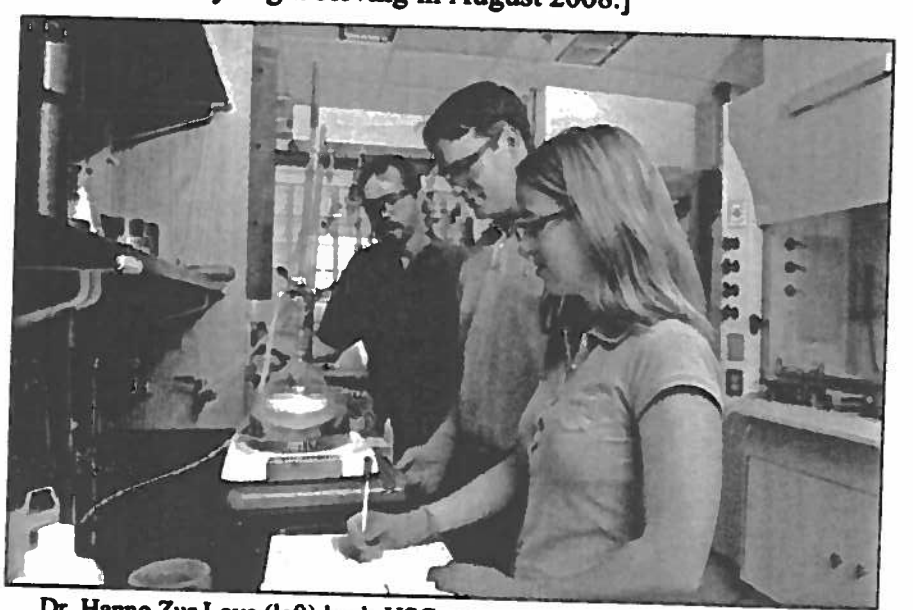
Kenneth Tew, John C. West Chair in Cancer Research

CoEE Name: **Polymer Nanocomposites**
Fiscal Institution: **University of South Carolina**

Award Date: 4/27/04
Award Amount: $3.5 million

Research at the Polymer Nanocomposites CoEE focuses on the development of new materials with improved properties for the polymers market. The plastics industry in South Carolina currently accounts for approximately five percent of the Gross State Product (GSP) of goods and services. Moreover, South Carolina is the national leader for production of PET polymers, which are used in the food packaging industry. The most important aspect of this industry is its vertical integration in SC, from up-stream raw materials producers to intermediate product producers of polymers to end-user fabricators. The plastics industry is currently experiencing commoditization of its basic materials (plastic polymers). This CoEE is hoping to transform the plastics industry and thus have a major impact on the state's manufacturing economy. This CoEE also is developing a pre-competitive research consortium to study the potential uses of nanomaterials to improve the performance of a variety of polyester polymers. The CoEE is one of a few academic groups in the nation which has a complete system for making PET nanocomposites by in situ polymerization. This CoEE has received a grant of $901,000 from the U.S. Air Force Research Laboratory to construct and evaluate polymer nanocomposite structures for application in high energy storage devices. As these applications are refined, the CoEE anticipates further partnerships with the several capacitor companies in SC, including KEMET and AVX. Significant achievements of the CoEE include developing a unique approach in the study of polymer nanocomposites where custom-made layered materials (clays and other inorganic solids) are synthesized with surface chemical groups tailored for compatibility with PET or other target polymers. This unique approach will allow further research in the area of PET polymers and will strengthen the CoEE's work in the defense industry. The CoEE has also applied for two U.S. non-provisional patents and one international patent regarding its work with polymers. Relationships have been formed with more than 20 manufacturers, plastic processors, and end-use fabricators including Michelin, MeadWestvaco and PBI Performance Products.

[USC hired Dr. Brian Benicewicz as the CoEE CHAIR IN MATERIALS SCIENCE AND ENGINEERING in Fall 2007. He will formally begin serving in August 2008.]



Dr. Hanno Zur Loye (left) leads USC research on polymer nanocomposites.

CoEE Name: **Hydrogen and Fuel Cell Economy**
Fiscal Institution: **University of South Carolina**

Award Date: 8/30/04
Award Amount: $5 million[1]

This CoEE is part of the larger Future Fuels™ Initiative, which is expanding USC's expertise in fuel cells and alternative energy. This CoEE conducts research to develop hydrogen storage materials and sensors for fuel cells. Fuel cells produce electricity from hydrogen and hydrogen-rich carbon fuels without thermal combustion and are more efficient for power generation than existing coal and natural gas technology. Along with other components of the Future Fuels™ Initiative, this CoEE will be housed in the Horizon Center, a $55 million public-private facility at USC Innovista. The two endowed chairs will work with public and private sector alliances such as the S.C. Hydrogen and Fuel Cell Alliance and the Greater Columbia Fuel Cell Collaborative. USC presently has the nation's only NSF Industry/University Cooperative Research Center for Fuel Cells (CFC). The research of this CoEE will increase the number of dues-paying Fuel Cell Center members from companies all over the world. Through the CFC, this CoEE has international collaborations with the Korea Institute of Energy Research and the Fraunhofer Institute for Solar Energy in Germany. Along with these two international collaborations, the CoEE has 20 national industrial partners through CFC. One startup company, Palmetto Fuel Cell Technologies, has been created through associated work of the CoEE. It serves the industry with hardware, designs, technologies and component products. Six spin-off companies have been created through associated work of the CoEE. In the past fiscal year, the CoEEs obtained a U.S. patent and formally presented eight scientific disclosures, filed ten U.S. provisional patent applications, two U.S. non-provisional patents and two international patent applications.

USC is actively recruiting the CoEE CHAIR IN SENSORS and the CoEE CHAIR IN HYDROGEN STORAGE MATERIALS.

The Horizon Center features 235,000 square feet of commercial office and laboratory space which will integrate Future Fuels™ research with industry within the Innovista community.

[1] The Hydrogen & Fuel Cell Economy CoEE was approved during 2003-2004. Funding for one half of this CoEE was provided in 2003-04, the other half in 2004-2005.

2004-2005 Centers of Economic Excellence

CoEE Name: **Travel and Tourism Technology**
Fiscal Institution: **University of South Carolina**
Collaborative Institution: **Coastal Carolina University**

Award Date: 8/30/04
Award Amount: $2 million

The purpose of the Travel and Tourism Technology CoEE is to provide innovation to the tourism industry through the creation of new technological standards that will allow hotels, airlines, rental car companies, restaurants and destination marketers to operate more efficiently. At present, technological applications such as software providers and web-based electronic commerce in the travel and tourism industry are severely outdated. As this CoEE makes new travel and tourism technology discoveries, it hopes to secure contracts with major corporations and tourism ministries as well as impact the South Carolina tourism industry ($14.5 billion in economic activity in 2002). The CoEE's three primary goals include: (a) assisting technology developers and travel and tourism businesses to establish and adopt technological standards in hardware, software and web-based applications; (b) discovering and testing new technological applications based on new industry standards; and (c) evaluating the effects of new technology on organizational structures with the goal of increasing the efficiency of corporate management. This CoEE currently is developing international collaborations with universities and Ministers of Tourism in several countries, including China, Uruguay, Guatemala and Brazil.

USC is in negotiations for the CoEE CHAIR IN TRAVEL AND TOURISM.

CoEE Name: **Gastrointestinal Cancer Diagnostics**
Fiscal Institution: **Medical University of South Carolina**

Award Date: 6/29/05
Award Amount: $5 million

The Gastrointestinal Cancer Diagnostics CoEE researches state-of-the-art translational medicine for gastrointestinal cancer patients, with hopes of decreasing the overall impact of cancer mortality and morbidity and closing disparity gaps throughout the state. Areas of research include molecular profiling, therapeutic targets, screening technologies, therapy, environmental interactions and population studies, with particular emphasis on esophageal cancer, which is highly prevalent in South Carolina. This CoEE anticipates receiving major research grants and the creation of spin-off companies as the result of its research. Funding has been received for the establishment of a non-CoEE chair who will conduct research with the CoEE chair-holder. Major non-state partners include the Spartanburg Regional Healthcare System along with six other hospital systems, the Department of Veteran Affairs, DHEC, the South Carolina Cancer Alliance, Roche Carolina, and Bank of America.

[MUSC recently announced the FY 2008 appointment of Dr. Melanie B. Thomas as the GRACE E. DEWOLFF ENDOWED CHAIR IN MEDICAL ONCOLOGY.]

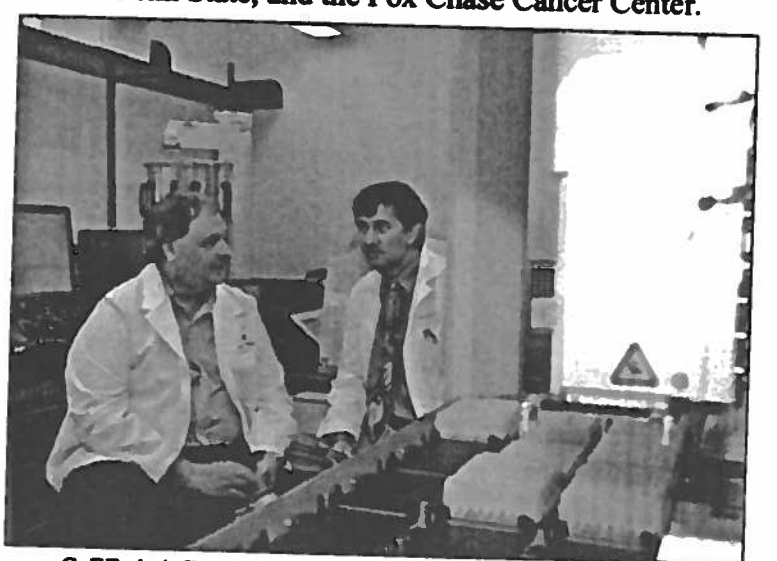
CoEE Name: **Cancer Drug Discovery**
Fiscal Institution: **Medical University of South Carolina**
Collaborative Institution: **University of South Carolina**

Award Date: 8/30/04
Award Amount: $5 million

The Cancer Drug Discovery CoEE provides mechanisms for target identification and generation of lead compounds in the drug discovery process, thus creating a productive interface (currently lacking in the field) between academics and the biotechnology/pharmaceutical industries. This CoEE also develops research in structural biology for target analysis, chemical biology for designing drug candidates, and advanced biomedical screening technologies. The CoEE's success is built upon the expertise and resources of its four endowed chairs, two of which were appointed in 2006. One of these, Dr. Charles Smith, has formed a high throughput drug screening core that contains chemical libraries with 50,000 compounds. Another chair-holder, Dr. John Lemasters is an expert in the advanced cellular technology of multiphoton confocal microscopy. His current projects center on the role of mitochondria in cell injury and death in cancer, heart and liver cells. During FY 2007, the CoEE had over $3.7 million in sponsored federal funding. As more researchers are added to the CoEE, funding is expected to increase by as much as 10% annually over the next five years. Researchers associated with CoEE authored 71 scientific publications during 2007.

Cancer Drug Discovery chair Dr. Charles Smith (left) and Regenerative Medicine chair Dr. Richard Swaja (right).

Dr. Charles Smith, CHARLES AND CAROL COOPER COEE ENDOWED CHAIR IN PHARMACY [appointed 2-1-06]. Smith's research mission is to design drugs that fight cancer by unlocking molecular mechanisms important for tumor growth. This work could enable the development of new drugs to fight a variety of inflammatory diseases, including arthritis, Crohn's Disease, and diabetic retinopathy. From research largely funded by the NIH, Smith holds nine patents. He has held faculty positions at Duke University, Penn State, and the Fox Chase Cancer Center.



CoEE chair Drs. Charles Smith (left) and Kenneth Tew (right), demonstrate robotic high-throughput drug screening instrumentation.

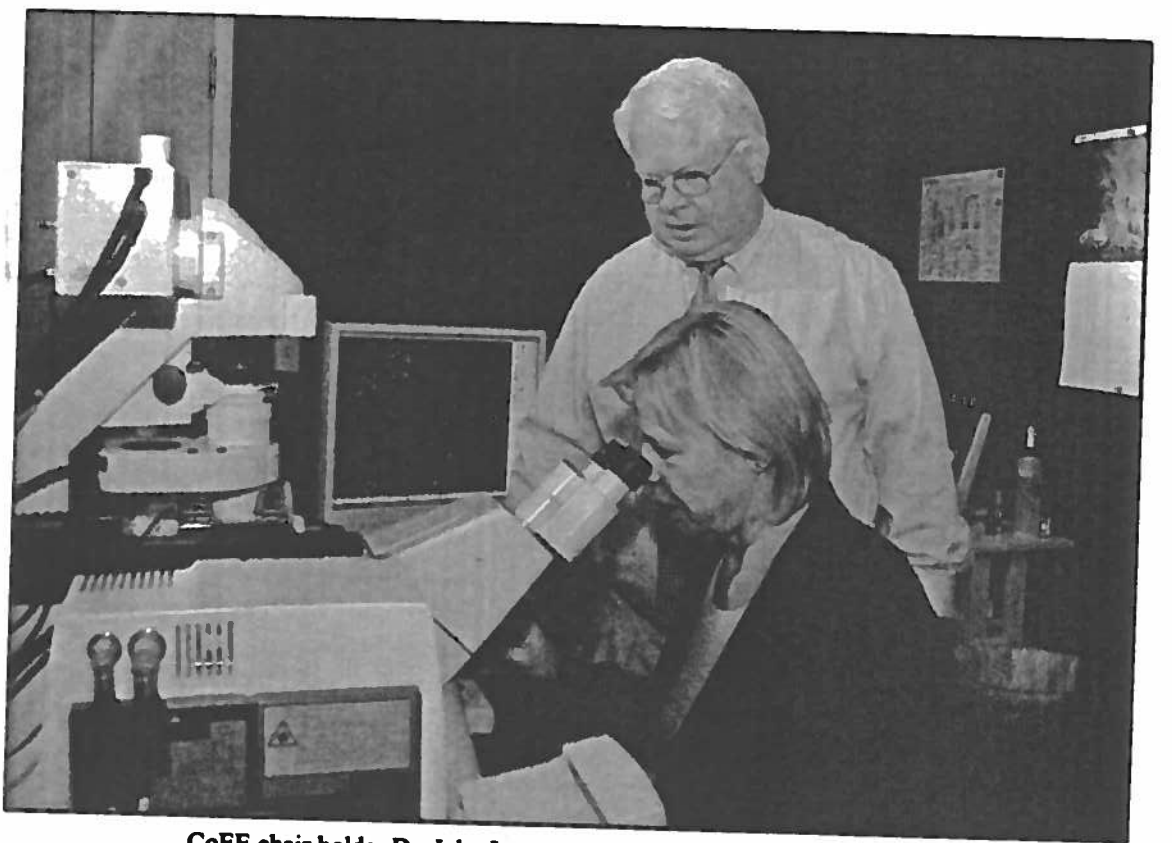
Cancer Drug Discovery CoEE [cont'd]

Dr. John Lemasters, CoEE Endowed Chair in Advanced Technologies [appointed 2-1-06]. Lemasters is a pioneer of techniques that allow scientists to see inside cells during reoxygenation (the restoration of oxygen to an organ following oxygen deprivation), which occurs following a heart attack or stroke. Lemasters specializes in microscopy that allows doctors to view slices of a single cell. His work is likely to help researchers understand the mechanisms by which the liver is injured through chronic alcohol use and how donated organs are damaged while being held for transplant surgery. Lemasters has served as director of the UNC Cell and Molecular Imaging Facility and the Confocal Imaging Facility. He holds five patents in confocal microscopy.

CoEE Chair Dr. John Lemasters.

USC is actively recruiting the CoEE Chair in Medicinal Chemistry.

MUSC is actively recruiting the CoEE Chair in Structural Biology.



CoEE chair holder Dr. John Lemasters (standing) and senior colleague, Dr. Anna-Liisa Nieminen, use sophisticated microscopy to examine living cells.

CoEE Name: **Vision Science**
Fiscal Institution: **Medical University of South Carolina**
Collaborative Institution: **University of South Carolina**

Award Date: 6/29/05
Award Amount: $4.5 million

The Vision Science CoEE focuses on the generation of new gene and pharmaceutical bases for the treatment of macular degeneration, glaucoma, retinitis pigmentosa, and other eye diseases. The three endowed chairs at this COEE will have expertise in the areas of gene-and pharmaceutical-based treatments for retinal degenerative diseases as well as bioengineering and material science techniques to develop novel products for improving surgical outcomes and drug delivery. This CoEE, along with the Vision Research Center, will serve as a platform for new product and business development and will create new jobs through the formation of start-up companies and the licensing of South Carolina intellectual property. The state economy will also be enhanced through the creation of new business opportunities for vendors and service-related businesses within the State. In 2007, the Vision Research Center obtained research contracts totaling over $450,000 from the following companies: Inotek Pharmaceuticals, Alcon Labs, Cara Therapeutics, Inc., AMO, OSI Pharmaceuticals, Bausch & Lomb, and Pfizer. Additionally, federal and foundational funding for the year totaled over $2.4 million from 16 grants. The most significant scientific accomplishments of the year were in the areas of retinal degeneration, glaucoma and cataract. The work of the Vision Research Center led to the publication of 26 papers in leading ophthalmic and basic science peer-reviewed journals.

MUSC is actively recruiting a CoEE Chair in Gene and Pharmaceutical Treatment of Retinal Degenerative Disease and a CoEE Chair in Bioengineering and Material Science Techniques.

USC is actively recruiting a CoEE Chair in Gene and Pharmaceutical Treatment of Retinal Degenerative Disease

CoEE Name: **Renewable Fuel Cells for the Fuel Cell Economy**
Fiscal Institution: **University of South Carolina**

Award Date: 6/29/05
Award Amount: $3 million

The Renewable Fuel Cells for the Fuel Cell Economy CoEE is a part of the larger Future Fuels™ Initiative which is expanding USC's expertise in fuel cells and alternative energy. Along with other components of the Future Fuels™ Initiative, this CoEE will be housed in the Horizon Center, a $55 million public and private facility at USC Innovista. The mission for this CoEE is to coordinate state and local research projects to attract additional capital investment in South Carolina for the fuel cell economy. The CoEE is developing new catalysts that allow alternative fuels to be produced from renewable sources. These new catalysts are the "next wellhead" as the transportation sector moves to less dependence on imported oil and on fuel which recycles carbon. This endowed chair-holder will work with the NSF I/UCRC for Fuel Cells and new and existing industries pursuing fuel cell opportunities as well as the Savannah River National Laboratory. [See information regarding NSF I/UCRC for Fuel Cells and technology transfer details at Hydrogen & Fuel Cell Economy CoEE summary on page 40.]

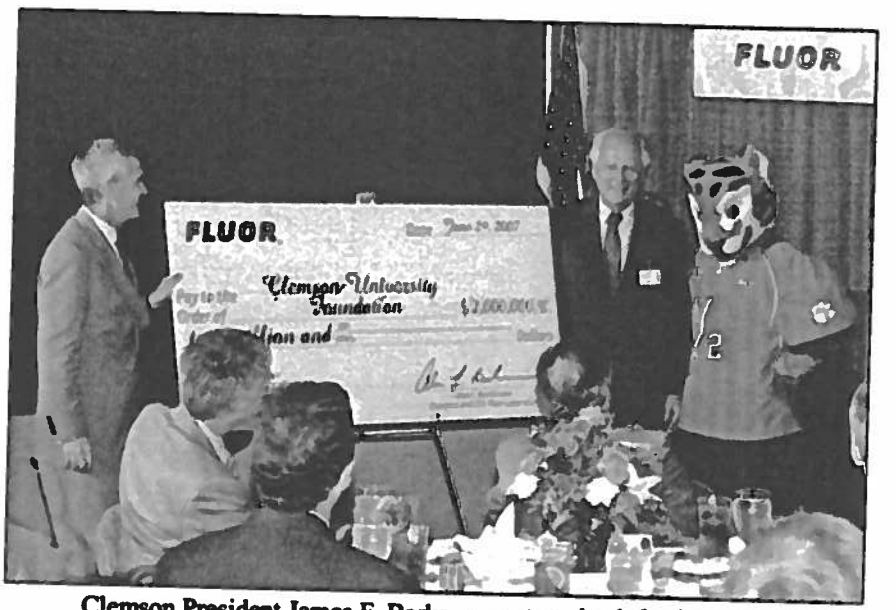
USC is actively recruiting the CoEE Chair in Renewable Fuel Cells.

SOUTH CAROLINA CoEE

2005-2006 Centers of Economic Excellence

CoEE Endowed Chair Name: **Supply Chain Optimization & Logistics** Award Date: 9/16/05
Fiscal Institution: **Clemson University** Award Amount: $2 million

The Supply Chain Optimization and Logistics CoEE is a component of a larger initiative, the Clemson Institute for Supply Chain Optimization and Logistics (CISCOL). Research at this CoEE centers on supply chain modeling, material handling, logistics, planning systems and distribution. The primary goals include: (a) conducting interdisciplinary research of multi-faceted problems associated with supply chain; (b) assisting in economic development by providing industries with access to Clemson's resources and expertise in supply chain activities; (c) delivering tangible products and services in the area of supply chain optimization and logistics through theoretical and applied research; and (d) conducting educational activities supporting technology transfer. This CoEE has received sponsored research funding from Southern Company, Michelin and Lockheed Martin totaling $180,000. Discussions for research funding are underway with Aerospace Engineering, IntelliTrans Solution, Alabama Power and Electric, AGS Resources and SPAWAR. Fluor Corp. is a full non-state partner for this CoEE.



Clemson President James F. Barker accepts a check for $2 million from Fluor Corp. Chairman and CEO Alan Boeckmann for the Fluor Endowed Chair in Supply Chain Optimization and Logistics.

Clemson is recruiting the FLUOR ENDOWED CHAIR IN SUPPLY CHAIN OPTIMIZATION & LOGISTICS.

"The success of the CoEE program is good news for the economic future of South Carolina and the health of the knowledge-based economy. The private sector's investment in this program validates its economic development potential. New, high paying jobs have been and are being attracted to the State."

Dr. Christian E.G. Przirembel
Vice President for Research & Econ. Development
Clemson University

CoEE Endowed Chair Name: **Urban Ecology and Restoration**
Fiscal Institution: **Clemson University**

Award Date: 9/16/05
Award Amount: $2 million

Through research, this CoEE supports the growth of the state's environmental industry. This CoEE will attract world-renowned faculty of restoration development who will create a knowledge-based industry cluster. This CoEE is unique for its interdisciplinary, integrative approach to the restoration of historic, ecological and urban infrastructure resources through the integration of basic ecological science, engineering, and urban design and planning. This CoEE is likely to fuel the creation of high-wage, knowledge-based professional opportunities that will bring evidence-based research and viable, applied, sustainable solutions to the restoration industry. Research outcomes at this CoEE will include the creation of engineering systems for integrated wastewater management and treatment; bio-filters and bio-remediation materials and techniques for toxic soils; materials and installation techniques for re-vegetated aquatic buffer and filtration zones; erosion and sedimentation control techniques and materials; recycled and advanced building materials; pervious pavement systems for roads and parking lots; and materials and techniques for propagation, installation, and maintenance of native plant species in urban settings. Collaborations are planned with the College of Charleston and the American College of the Building Arts in Charleston.

Clemson is actively recruiting the CoEE CHAIR IN URBAN ECOLOGY AND RESTORATION.

CoEE Endowed Chair Name: **Advanced Fiber-Based Materials**
Fiscal Institution: **Clemson University**

Award Date: 6/13/06
Award Amount: $4 million

The 2002 Palmetto Institute Report identified advanced materials as a seed cluster industry in the state. The Advanced Fiber-Based Materials CoEE intends to be a catalyst in repositioning existing manufacturing resources to support new industry opportunities in this field. Research at this CoEE concentrates on the composition of novel fiber materials, fabrics and integrated components which possess unique functionality and value-added performance over traditional textile materials. This CoEE is developing a niche industry in high-tech fibers and materials including fiber-reinforced composite materials based on metals, ceramics and polymers. A multimillion-dollar non-state match was donated by the J.E. Sirrine Textile Foundation. Clemson is in continued conversation with Dow Chemical and DuPont to receive additional research support.

Clemson Materials Science and Engineering faculty member Dr. Phil Brown and Greer High School teacher Mr. Randy Hutchison conduct an experiment on the wicking properties of deep-groove fibers.

Clemson is actively recruiting the CoEE CHAIR IN ADVANCED FIBER-BASED MATERIALS.

CoEE Endowed Chair Name: **Molecular Nutrition and Nutrigenomics** Award Date: 6/13/06
Fiscal Institution: **Clemson University** Award Amount: $2 million

The Molecular Nutrition CoEE seeks to become the foremost center of scientific information on energy balance and obesity treatment. This CoEE researches the fundamental mechanisms by which macronutrients and micronutrients interact with the human genome to promote wellness and prevent disease. Goals for the CoEE include: (a) fostering basic research in food plant nutrigenomics, molecular nutrition, and molecular epidemiology; (b) enhancing existing molecular nutrition related graduate and postdoctoral training programs; (c) translating basic research into services such as obesity prevention and fitness promotion, treatment of weight disorders, and public health recommendations; and (d) collaborating with the private sector to develop small business grants that lead to long-term partnerships. South Carolina's $1 billion food industry advantageously positions the Molecular Nutrition CoEE for partnerships and support from the SCRA Innovation Centers and SC Bio. This CoEE will also partner with nutraceutical and/or life science industries as well as life science-based companies that develop gene-based diagnostics/services and nutrition-based companies that manufacture designer foods and health supplements. The CoEE benefits from collaborations with the Clemson University Institute for Nutraceutical Research and the South Carolina Nutrition Research Consortium. Faculty related to the CoEE published 24 scientific papers in 2006-07.

Clemson is actively recruiting the CoEE CHAIR IN MOLECULAR NUTRITION & NUTRIGENOMICS.

CoEE: **Molecular Proteomics in Cardiovascular Disease & Prevention** Award Date: 6/13/06
Fiscal Institution: **Medical University of South Carolina** Award Amount: $5 million

The Molecular Proteomics in Cardiovascular Disease and Prevention CoEE works to translate advances in cardiovascular prevention and treatment "bench" science into clinical "bedside" care. This CoEE has five initial goals: (a) developing measurement systems to detect early indicators of heart failure; (b) relating diagnostic protein signatures to clinical outcomes; (c) developing therapeutic management strategies; (d) creating a statewide network to develop, test, and improve clinical care of heart failure; and (e) transferring technology into new South Carolina industries. The CoEE is in discussions with a company to develop a biomarker testing system, a device envisioned as a desktop, office instrumentation which will inexpensively measure protein markers to create individualized risk profiles for development of chronic heart failure. A spin-off company is also anticipated for the development of plasma protein detection methods using customized beads which have fluorescent antibodies attached to them. This CoEE has potential to yield major economic impact in the short-term. In 2006-07, the CoEE entered a research contract with Ortho Clinical Diagnostics for $950,000. The CoEE and Ortho Clinical also entered an intellectual property licensing agreement. Research associated with the CoEE published three scientific papers.

MUSC is actively recruiting the TOURVILLE COEE CHAIR IN CARDIOVASCULAR IMAGING FOR DIAGNOSIS AND PREVENTION and the VOLPE COEE CHAIR IN CARDIOVASCULAR BIOMARKER DEVELOPMENT FOR DIAGNOSIS AND PREVENTION.

CoEE Name: **Solid Oxide Fuel Cells**
Fiscal Institution: **University of South Carolina**

Award Date: 6/13/06
Award Amount: $3 million

The Solid Oxide Fuel Cells CoEE is a part of the larger USC Future Fuels™ Initiative. Solid oxide fuel cells are one of the two leading types of fuel cells available for commercialization and are expected to find application in large, high-power systems such as full-scale industrial and large-scale electricity-generating stations. The proposed CoEE will expand the collaboration USC has for fuel cell development at the NSF I/UCRC, which currently has 14 dues-paying members jointly working on generic aspects of fuel cell systems in a shared, precompetitive manner. [See additional information regarding NSF I/UCRC for Fuel Cells at the Hydrogen & Fuel Cell Economy CoEE summary on page 40.] This CoEE's work is to remove barriers for the use of solid oxide fuel cells in society by: (a) designing components to accommodate variations in temperature and transport associated with practical uses; (b) understanding long-term behavior and durability of solid oxide fuel cell systems; (c) developing testing protocols that simulate solid oxide fuel cells behavior over prolonged time periods; and (d) developing systems for stationary power generation. The Air Force Office of Scientific Research is funding research at this CoEE for structural aircraft applications for $300,000. Also, Exxon Mobil/Yokohama awarded a $200,000 grant to this CoEE to study cold temperature fatigue of inner liner materials. This CoEE has also developed collaborations with the Savannah River National Laboratory and the NASA Glenn Research Center.

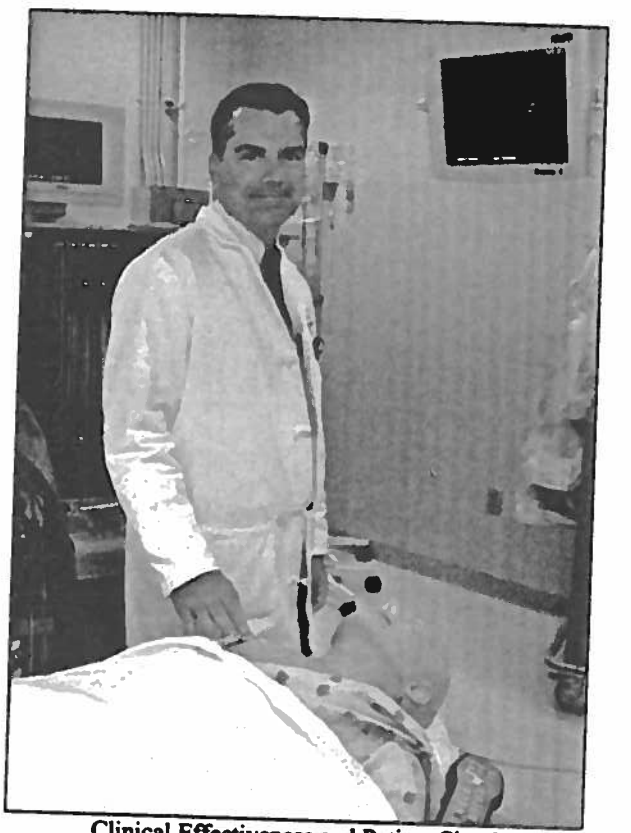
Dr. Kenneth Reifsnider, CoEE Chair in Solid Oxide Fuel Cell Research [appointed 3-1-07].

CoEE chair Dr. Kenneth Reifsnider is a member of the prestigious National Academy of Engineering—the only Academy member working in South Carolina.

Reifsnider's research specialty is in the field of mechanical engineering, with a focus on the way materials "behave"—their durability, damage tolerance, and the way they perform over time. His particular interest is in fuel cell science and engineering—creating practical and marketable fuel cells and systems that can meet future energy needs and benefit society. Fuel cells are continually replenished with fuel and thus provide a continuous supply of electric power without running down like a battery. Solid oxide fuel cells convert chemical energy directly into electrical energy. Applications for these fuel cells include large-scale power distribution for municipalities, rural areas, and industries, as well as heat and power for homes. They could also provide mobile power for computers, cell phones, and other electronics. Solid oxide fuel cells are highly efficient; operate with a number of fuels, including renewable fuels; and produce very low amounts of greenhouse gasses and pollution. Reifsnider is also director of the USC Solid Oxide Fuel Cell (SOFC) program and previously served as director of the Connecticut Global Fuel Cell Center at the University of Connecticut.

CoEE Name: **Clinical Effectiveness and Patient Safety** Award Date: 9/16/05
Fiscal Institution: **Medical University of South Carolina** Award Amount: $5 million
Collaborative Institutions: **University of South Carolina & Clemson University**

The Clinical Effectiveness and Patient Safety CoEE improves clinical education and patient safety through the use of simulation technology. Its goals include improving the quality of delivered care, advancing the practice and training of the medical workforce from student nurses to practicing physicians, and becoming an international focal point for health sciences education and innovative research in education and safety. The central administrative office for the CoEE is located on the MUSC campus with multiple simulation sites operating at Palmetto Health Alliance, USC College of Medicine, MUSC and at Greenville Hospital System in partnership with Greenville Technical College. A nursing-focused simulation center will be developed at the USC College of Nursing. The Greenville Healthcare Simulation Center hired 5 employees and offered 33 simulation sessions to 256 participants in 2007; while the MUSC Healthcare Simulation Center hired 3 staff members and offered 117 simulation sessions to 220 participants. To facilitate the delivery of these sessions, a simulation course development manual has been created using Dr. Schaefer's proven methods for complete simulation learning. B-Line Medical is creating a simulation learning management and data system and has engaged the CoEE in its development process. The system will be the first of its kind and will help to capture simulation data for education and research. Research in FY 2007 provided the impetus for a successful, $100,000-plus grant for Maternal-Fetal Crisis and Emergency Response Team Development and Training. This CoEE is a major recipient of the $21 million Duke Endowment grant.



Clinical Effectiveness and Patient Simulation CoEE chair Dr. John Schaefer.

USC is actively recruiting a CoEE CHAIR IN CLINICAL EFFECTIVENESS & PATIENT SAFETY.

Clemson is reevaluating the specific disciplinary expertise needed for the CoEE CHAIR at Clemson.

Dr. John Schaefer, LEWIS BLACKMAN CoEE ENDOWED CHAIR FOR PATIENT SIMULATION AND RESEARCH FOR HEALTH SCIENCES SOUTH CAROLINA [appointed 2-1-06]. Schaefer is working to reduce patient injury during airway management procedures using mannequin-based simulators. These procedures ensure that a person can breathe while receiving treatments such as anesthesia, CPR, or emergency medical attention. Airway management during such procedures is a common source of un-intended patient injury. Schaefer founded the Peter M. Winter Institute of Simulation, Education, and Research at the University of Pittsburgh Medical Center, one of the world's leading patient simulation facilities.

CoEE Name: **Childhood Neurotherapeutics**
Fiscal Institution: **University of South Carolina**
Collaborative Institution: **Medical University of South Carolina**

Award Date: 6/13/06
Award Amount: $5 million

The Childhood Neurotherapeutics CoEE utilizes recent advances in pharmacogenetics, metabolic disorders, and neuroinflammatory diseases to study neurological disorders in children. Research at this CoEE will be particularly focused on the prevention of brain damage in premature infants (neuroprotection) and the curing of infant brain diseases through cellular engineering. In collaboration with the Greenville Hospital System, this CoEE operates a statewide team that is developing neural stem cell therapeutic approaches to neurological disorders in children. Neural stem cells have recently been identified as having high repair capacity, particularly during development. This important scientific discovery will allow the CoEE to impact the treatment of these disorders and to transfer research knowledge directly to patient application. NIH is funding a clinical study to MUSC for treatment of mothers with chorioamnionitis which is inflammation of the amniotic membranes caused by infection and the Federal Drug Administration has awarded a grant to MUSC and the Children's Hospital of Philadelphia to evaluate the efficacy of atorvastatin, an HMG CoA reductase inhibitor, for patients with type 1 diabetes. These studies have prompted the start of a spin-off company, ImmunoMod, which develops drugs for treatment of diabetes. The CoEE has been granted two U.S. patents and has submitted a total of four U.S. provisional and six non-provisional patent applications along with ten international patent applications.

Dr. Rose Booze, PI for the Childhood Neurotherapeutics CoEE and Kadian Simms (undergraduate student) examine brain tissue under a microscope.

USC is actively recruiting the CoEE CHAIR IN CHILD & ADOLESCENT NEUROCHEMISTRY AND the CoEE CHAIR IN TRANSLATIONAL THERAPEUTICS.

MUSC is actively recruiting the CoEE CHAIR IN NEURODEVELOPMENTAL DYSFUNCTION.

"South Carolina's political leadership should be commended for creating and supporting the Centers of Economic Excellence Program during the past five years. Continuing to fully fund this effort must be a high priority. Changing course would be devastating, costing us precious momentum in our battle to gain ground toward greater success in the knowledge economy."

Presidents James Barker (Clemson), Raymond Greenberg (MUSC) and Andrew Sorensen (USC), from op-ed piece "Endowed Chairs a Smart Investment in Future" (reprinted with permission from *The State*)

2006-2007 Centers of Economic Excellence

CoEE Name: **Health Care Quality**
Fiscal Institution: **University of South Carolina**
Collaborative Institution: **Medical University of South Carolina & Clemson University**

Award Date: 8/28/06
Award Amount: $5 million

The Health Care Quality CoEE seeks to become a nationally prominent research center that capitalizes on recent scientific discoveries and technological advances, as well as South Carolina's unique characteristics and resources, to conduct innovative research on the state's major health problems. The ultimate goal of this enterprise is to improve the health of the state's population and its economic well being. This multi-dimensional, collaborative CoEE is creating an electronic health portal and developing a clinical research organization. Additionally, the CoEE is establishing a clinical research education unit through resources made available by Health Sciences South Carolina and the Duke Endowment. In its formative stage, the CoEE has created joint-working groups in translational research, medical informatics and a state health data portal. This CoEE is also identifying a potential network and processing and storage opportunities with IBM, Collexis and HealthPathways. During FY 2007, this CoEE issued an RFP for the development of interoperable electronic health records to be used throughout the state; a committee is now in the process of selecting a lead contractor. Also, in conjunction with the Medical College of Georgia, this CoEE formed a regional collaborative and is competing for a $50 million NIH Clinical Translational Research Award.

[MUSC hired Dr. Iain Sanderson as the CoEE CHAIR IN MEDICAL BIOINFORMATICS in FY 2008.]

[USC hired Dr. Jay Moskowitz as the CoEE CHAIR IN TRANSLATIONAL CLINICAL RESEARCH on October 1, 2007.]

"The CoEE program is a critical tool in our efforts to build the state's life sciences sector. MUSC now boasts seven highly respected CoEE professors working to develop new health technologies to improve patient care. Without the program, it would have been extremely difficult to recruit these talented individuals."

President Raymond S. Greenberg
Medical University of South Carolina

Newly appointed CoEE chair Dr. Ian Sanderson shares his center's visions for success with CHE Deputy Director Dr. Gail Morrison.

CoEE Name: **Health Facilities Design and Testing**
Fiscal Institution: **Clemson University**
Collaborative Institution: **Medical University of South Carolina**

Award Date: 6/18/07
Award Amount: $5 million

The CoEE in Health Facilities Design and Testing is an interdisciplinary and multi-institutional platform for collaborative educational, research and public service initiatives to study relationships between the design of healthcare settings, human health and healthcare delivery. The primary purpose of the CoEE is to expand and disseminate knowledge on: (a) how health facility design impacts health and healthcare delivery; and (b) how to create architectural settings that better support the health and well-being of patients and staff. Through research, this CoEE will address the relationship between the physical healthcare environment and the four following areas: health and clinical outcomes; patient, family and staff satisfaction; operational efficiencies; and the ability to accommodate change. Two design, fabrication and testing prototype facilities are planned, one at MUSC and one at Spartanburg Regional Healthcare System.

Clemson is actively recruiting the CoEE Chair in Architecture and Health Research.

MUSC is actively recruiting the CoEE Chair in Human Factors Medical Research.

CoEE Name: **Tobacco-Related Malignancy**
Fiscal Institution: **Medical University of South Carolina**

Award Date: 6/18/07
Award Amount: $5 million

The CoEE in Tobacco-Related Malignancy is devoted to discovering biomarkers of tobacco-related malignancies. The initial focus will be on lung cancer, but it hopes to also make advances in other tobacco-related malignancies including head and neck, bladder and esophageal cancers. The goals of this CoEE include: (a) identifying biomarkers of tobacco-related malignancies using genomics, proteomics and lipidomics; (b) employing epidemiologic techniques to validate biomarkers; (c) integrating bioinformatics to evaluate discovery efforts and to mine cancer data-bases; (d) developing a networked tissue repository; and (e) developing and implementing clinical trials to evaluate the use of new biomarkers. The CoEE, in conjunction with the Hollings Cancer Center, will partner with the Department of Veteran Affairs, the S.C. Department of Health and Environmental Control, the S.C. Cancer Alliance, and various hospital systems across the state to facilitate the biomarker discovery, validation and development processes. These same partners, along with HSSC, the Medical University Hospital Authority and the Medical College of Georgia, will work with the CoEE to develop a distributed tissue repository and a clinical trials network. This CoEE will also participate in the Hollings Cancer Center's 2008 submission for a National Cancer Institute P30 grant.

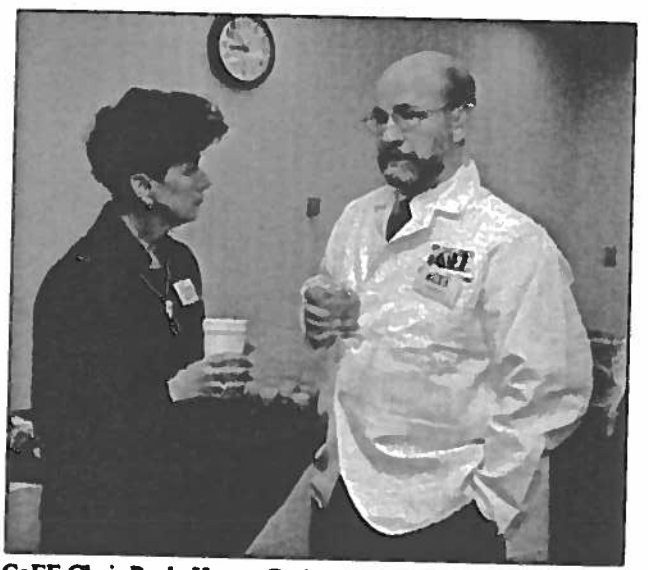
MUSC is actively recruiting the CoEE Chair in Cancer Biomarker Development.

MUSC is actively recruiting the CoEE Chair in Molecular Epidemiology.

CoEE Name: **Stroke**
Fiscal Institution: **Medical University of South Carolina**
Collaborative Institution: **University of South Carolina**

Award Date: 6/18/07
Award Amount: $5 million

The CoEE in Stroke enhances the existing stroke program at MUSC and strengthens the clinical and basic stroke research in South Carolina. The reduction in the incidence of stroke and the provision of acute stroke care are goals of this CoEE. With three endowed chair positions, this CoEE will increase translational stroke research and stimulate the development of new therapeutics, emphasizing drug discovery and biotechnology. This collaborative effort enhances the research programs of MUSC, USC, Greenville Health Systems and the Greenwood Genetics Center. In FY 2007, this CoEE began to develop the REACH (Remote Evaluation of Acute Ischemic Stroke) network. The network will provide around-the-clock, Internet-based stroke consultation for patients within the first three hours of a stroke occurrence. Both MUSC and USC will serve as hubs for this network, with "virtual spokes" reaching out to community hospitals throughout the state. Five community hospitals have already agreed to connect to this network, including McLeod Health (Florence), with six other hospitals considering connection.



CoEE Chair Paula Harper Bethea (left) discusses the REACH network developed by CoEE chair Dr. Robert Adams (right).

MUSC is actively recruiting the CoEE CHAIR IN CLINICAL NEUROLOGY.

USC is actively recruiting the CoEE CHAIR IN TRANSLATIONAL NEUROLOGY.

[MUSC hired Dr. Robert Adams as the CoEE CHAIR IN STROKE in August 2007.]

REACH STROKE NETWORK
A Health Sciences South Carolina Supported Initiative

CoEE Name: **Rehabilitation and Reconstruction Sciences**
Fiscal Institution: **University of South Carolina**

Award Date: 6/18/07
Award Amount: $5 million

The CoEE in Rehabilitation and Reconstruction Sciences is focused on medical and public health needs in the area of orthopedic disorders, exercise and sports-related injury prevention, treatment and rehabilitation. Collaboration among the four intellectual cores, Cellular Engineering, Rehabilitation and Performance Sciences, Epidemiology and Clinical Translation, and Education, helps to translate basic science to bedside care. The CoEE investigates the biologics of tissue-engineered materials and implantable devices to find solutions to a variety of musculoskeletal maladies. Partners of this CoEE include Smith and Nephew, Steadman Hawkins Clinic of the Carolinas, and Orthopaedic Research Foundation of the Carolinas. Representatives from each of these non-state partners along with representatives from USC formed a steering committee which met quarterly throughout this last year. Smith and Nephew, a global leader in the development and marketing of medical devices, provides committee participation as well as substantial funding for the CoEE.

USC is recruiting the CoEE CHAIR IN RECONSTRUCTIVE METHODOLOGIES AND MATERIALS.

CoEE: **Strategic Approaches to Electricity Production from Coal**
Fiscal Institution: **University of South Carolina**
Award Date: 6/18/07 Award: $5 million

The CoEE in Strategic Approaches to Electricity Production from Coal focuses on the synthesis, characterization and testing of novel catalysts and adsorbents with applications in the power generation industry. Coal is the cheapest and most widely available energy source and will be used for another two to three decades by energy providers. However, the environmental impact of coal-burning is substantial. The long-term research objective of the CoEE, therefore, is to improve the environ-mental control technologies for coal power plants, including the design of improved environmental control systems for mercury and acid gas emission control and the development of new materials and processes for carbon sequestration and storage/ utilization. Santee Cooper, the leading electrical cooperative in the state, will provide the non-state matching funds for this CoEE.

Dr. Michael Amiridis, principal investigator for the Strategies Approaches to Electricity Production from Coal CoEE.

USC is actively recruiting the COEE CHAIR IN STRATEGIC ENVIRONMENTAL APPROACHES TO ELECTRICITY PRODUCTION FROM COAL.

"We look forward to being a leader in this very important research, which has enormous potential for benefiting consumers, stimulating the economy, making coal use more economical, and protecting our environment."

University of South Carolina President Andrew Sorensen, on the CoEE in Strategic Approaches to Electricity from Coal

CoEE Name: **SeniorSMART™**
Fiscal Institution: **University of South Carolina**
Collaborative Institution: **Clemson**
Award Date: 8/20/07
Award Amount: $5 million[1]

This CoEE focuses on multidisciplinary research to foster independence for seniors through developing technologies and strategies that prevent, delay or mitigate the main causes and impacts of disabilities. This CoEE has three major themes: SHARP BRAIN (helping maintain intellectual activity); SMART WHEELS (promoting independent mobility outside the home); and SMART HOME (helping maintain independent mobility inside the home). Collaborations have begun with Lutheran Homes of South Carolina for SmartHOME investigations, and with the Fraunhofer Institutes at the University of Kaiserslautern (Germany) for SmartHOME technology. The CoEE has garnered $3.9 million in federal funding from the Health Resources and Services Administration, Centers for Disease Control and the Department of Health and Human Services. Two other federal grants with NIH totaling $4.8 million are pending.

USC was awarded a COEE CHAIR FOR COMMUNITY AND SOCIAL SUPPORT and a COEE CHAIR FOR MEMORY AND BRAIN FUNCTION.

Clemson was awarded a CoEE Chair for Driving, Mobility, and Physical Functioning.

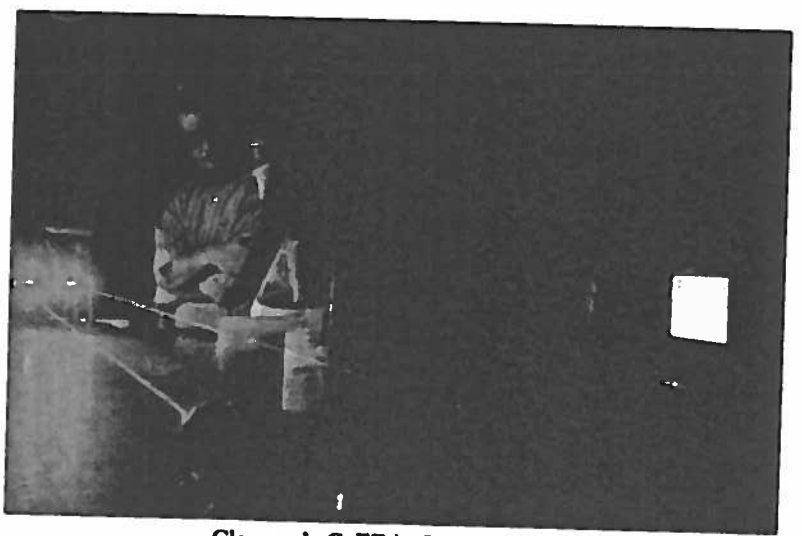
[1] The SeniorSMART™ CoEE was approved in 2007-2008. Funding was provided from 2006-2007 dollars.

V. CoEE Economic Impact Achievements

S.C. businessmen Mr. Ed Sellers (left), Mr. Larry Wilson (center) and Clemson Research V.P. Dr. Chris Przirembel (right).

"[I]t is in the public interest to create incentives for the senior research universities of South Carolina consisting of Clemson University, the Medical University of South Carolina, and the University of South Carolina to raise capital from the private sector to fund endowments for professorships in research areas targeted to create well-paying jobs and enhanced economic opportunities for the people of South Carolina...."

FROM THE S.C. RESEARCH CENTERS OF ECONOMIC EXCELLENCE ACT [§ 2-75-5]



Clemson's CoEE in Optical Materials features state-of-the-art optical laser equipment.

University Technology Transfer – Timing is Everything

by W.C. "Chip" Hood, Jr., J.D.

University discoveries have added billions of dollars to the U.S. economy, supported hundreds of thousands of jobs and spawned new businesses, industries and markets. Since the 1980 enactment of a federal statute encouraging university technology transfer (Bayh-Dole Act), universities have been awarded almost 3,000 patents. Most importantly, university technology transfer has greatly improved our quality of life.

As a leader in the basic science and engineering research fields, universities account for about 14% of the nation's R&D work. University discoveries are often groundbreaking and create new technological fields. These basic science discoveries can provide the underpinnings for commercial products and the creation of new economies. However, commercialization of university discoveries is both time and capital intensive due to this being the earliest stage in product or technology development.

As not-for-profit institutions, universities do not typically commercialize their discoveries themselves. They instead look for commercial partners to whom they can transfer the rights to develop and sell the technology. This is most often done by granting a license to university patented technology – legal permission for an entity to make, use and sell the patented invention. The entire technology transfer process from discovery to commercialization is typically a fairly lengthy undertaking, often taking 5 to 10 years before a product is ever sold.

A Center of Economic Excellence award is a good example of the technology transfer process. Initially, an area of research focus with economic development potential is identified by a university and application is made to the CoEE Review Board. If the Review Board grants an award, then the university must acquire non-state matching funds and recruit one or more chair-holders. All this takes time; in fact, several years may pass between the awarding of a CoEE proposal and the beginning of substantial research. Even once research begins, there is no set timeframe for discovery: invention can occur immediately; it can occur several years into the project; or it can occur well after the initial research ends during follow on projects.

Once a new discovery is identified, it is evaluated for commercial potential by technology transfer professionals at the university. Some discoveries, while immensely groundbreaking in a field, may not be patentable or easily commercialized. However, the discovery may create the groundwork for an entire new field of science, thus contributing greatly to the greater good by fostering a climate of innovation around the university and attracting industry to the area.

For discoveries with commercial potential, the university normally undertakes the filing of initial patent applications to protect the discovery. Patent protection, akin to a 20-year "claim stake" for making, using or selling the discovery, is critical to providing incentive for commercial partners and investors to fund further development of the discovery. The university seeks to locate commercial partners to undertake the commercialization of the discovery – turning the basic science into a product. In some cases, CoEE partners may be willing to undertake the commercialization phase. Locating a commercial partner is often a time-consuming process and can itself take up to 3 to 4 years.

In exchange for the transfer of intellectual property rights to the commercial partner (usually via a license agreement) the university typically receives a royalty on sales (normally 1%-10%, but this is dependent on the specific technology and its stage of development). For startup companies formed around the discovery, equity may also be paid to the university partner in exchange for a license. But most importantly, the discovery and its licensure results in jobs creation in the local economy.

The licensing company then must begin the often difficult process of turning a basic discovery into a commercial product. This involves additional R&D, often raising investment money, and for some fields extensive regulatory approval activities. The life science and medical areas in particular take massive amounts of capital to move a discovery forward. Additionally, for products regulated by the FDA, clinical trials are often required, adding even more years to the commercialization process. It is not uncommon for a new medical discovery to take hundreds of millions of dollars and 8-10 years before a product is approved and ready for market.

While the path to commercialization is often difficult, there are many benefits to the university and the local and state economy. Research funding from the commercial partner is often paid to the university. For local license holders, an economic stimulus occurs due to job creation, real estate transactions, professional service procurement, tax payments and support services. Average wages are typically significantly higher for technology companies, and even basic support service wages such as administration and sanitation at high tech companies are higher than average. (It is important to note that these economic benefits are realized during the often lengthy road to a commercial product, not just once a product is deemed successful.)

While the timing can vary from discovery to discovery, it is easy to see that the fruits of the investment into the CoEE program can take several years before economic harvest. And in the case of life science-related products, one can easily expect at least a 10-year wait for each successful product. So is it worth the wait? Since 1980, **over 2,000 companies** based on university and National Institutes of Health research have been founded. The V-chip, the PSA test for prostate cancer, hip implants, Taxol are but a few of hundreds of discovery-to-commercial product success stories. University Technology Transfer was also critical in developing the science-based economies of the North Carolina Research Triangle Park and California's Silicon Valley. In other words, University Technology Transfer was—and remains—a key building block for transforming businesses and industry.

Suggested reading list on technology transfer
and knowledge-based discoveries and commercialization:

www.ipmall.info/hosted_resources/crs/RL32076-061208.pdf
www.milkeninstitute.org/pdf/mind2mrkt_2006_exec.pdf
www.bio.org/ip/action/tt20030710.asp
www.betterworldproject.net/reports.cfm
www.fda.gov/cder/handbook/develop.htm

Mr. Hood is the Executive Director of the MUSC Foundation for Research Development.

CoEE Economic Impact Success Stories

Following the award of a Center of Economic Excellence, each research institution has 78 months in which to draw down the sum total of the state award (between $2 million to $5 million). Approximately the same amount of time can be required to recruit a world expert in the rarefied research field of an individual CoEE. Yet only four years into the program, a number of CoEEs have already made a major impact on the state's economy. Listed below are some major program economic development highlights through the end of FY 2007. [For a complete list of all technology transfer data, please consult the table and detailed summary beginning on page 63.]

The **CoEE endowed chair in Automotive Design and Development**, part of the CU-ICAR initiative, has partnered with Timken Company (Fortune 500), a well-known provider of automotive industry products and solutions based on friction management and power transmission. Timken has established research and development facilities on the CU-ICAR campus in Greenville and has relocated its automotive powertrain engineering resources to a new worldwide powertrain engineering center at CU-ICAR. This partnership has already generated more than 170 high-paying jobs in the Upstate.

The **CoEE endowed chairs in Automotive Manufacturing** and **Automotive Systems Integration** (CU-ICAR) are in major discussions to establish private sector partnerships with companies such as General Motors, IBM, Toyota, Honda, Daimler-Chrysler, Hewlett-Packard, Nissan, and the Robert Bosch Corporation. These chairs have conducted workshops for several years with BMW, Michelin, Timken, and Siemens to promote industry involvement in CU-ICAR's research initiatives. BMW has located its Information Technology Research Center on the CU-ICAR campus. More than 200 engineers and technicians are housed in this facility.

The **CoEE endowed chair in Vehicle Electronic Systems Integration** (CU-ICAR) is establishing the Clemson Vehicular Electronics Consortium which will provide companies access to automotive research at Clemson. Plans to pursue funding for an anechoic chamber and facilities are underway; this facility will provide an EMC test capability, which will save automotive companies' time and resources and attract new industry into the state.

The **three CoEE endowed chairs of CU-ICAR** and their teams were awarded 16 grants totaling $1-plus million from federal and corporate sources with seven pending proposals submitted totaling nearly $6 million. Also, during FY 2007, Michelin received a National Institute of Standards and Technology Advanced Technology Program award for which CU-ICAR submitted a budget portion for $2.1 million. These funds are anticipated within two years.

The **CoEE in Proteomics** has been successful in obtaining a patent for electrospray ionization, which will hopefully soon lead to licensure. This CoEE has applied for a total of nine invention disclosures. The MUSC Proteomics Center is also the recipient of the largest competitive extramural research award (granted in 2003-04) ever received in the state ($18.7 million). In addition, a $500,000 NIH Shared Instrumentation Grant was secured in 2005-06 for the purchase of a mass spectrometer for tissue imaging research.

The **CoEE in Neuroscience** has partnered with Cure Parkinson's Project, a non-profit corporation which engages in faculty recruitment and provides infrastructure and equipment to help cure Parkinson's Disease. As a component of the Neuroscience Institute, this CoEE will continue MUSC's affiliations with companies like AstraZeneca, Pfizer, Merck, and Janssen Pharmaceuticals. The Center has also supported the creation of SemiAlloGen, Inc., a biotech startup company which develops therapeutics in the field of neurodegenerative disorders and cancer. It is also anticipated that endowed chair Dr. Miguel Pappolla's research in compounds that limit the extent of Alzheimer's Disease will be translated into a startup company or existing company. The CoEE is developing a project with Jazz Pharmaceuticals to test mechanisms of action of their drug Xyrem. A medical device company Cyberonics, Inc. has supplied equipment worth $30,000 and consulting expertise in modulating cognitive processes to the CoEE.

The **CoEE in Marine Genomics** has begun to market its intellectual property as well as tangible products to the business and scientific community. The genomics group has sold a diagnostic gene chip to the International Oyster Microarray Consortium on a cost-recovery basis. This continuing relationship has raised the profile of the marine genomics group in the international community. In the past year, the CoEE has generated intellectual property based on a major discovery that RNA injected into shrimp could protect them against viral infections. This discovery has major implications on shrimp aquaculture, which is periodically devastated by viral infections. Commercial opportunity is strong if an effective pathway of RNA delivery, other than injections, is developed. The CoEE has partnered with two private companies, Shrimp Improvement Systems and Biogenmar, and is negotiating a formal relationship with a third company, Martec. These relationships have strong potential to translate intellectual property into licenses, products and jobs in the aquaculture and bioscience areas. The CoEE is also in discussion with Chugai Pharmaceutical Company about the development of marine pharmaceuticals using microbial genomics technology.

The **CoEE in Regenerative Medicine** has fostered a spin-off company, FirstString, which markets new wound repair technology. In its start-up phase, FirstString has garnered over $600,000 worth of investment and was chosen for support by the SC Launch! Program and the NIH Small Business Technology Transfer Program. FirstString Research is preparing for its first U.S. human clinical trials. MUSC and the Mayo Clinic are among options for the testing sites.

The **CoEE in Nanostructures** has received funding in the amount of $915,000 from the Army Research Office for study of integrated sensor technologies for chemical, biological, and radiation detection. The National Science Foundation has granted funds totaling $690,000 for work in reprogrammable parallel nanomanufacturing and fundamental experimental properties of mesoscopic systems. Funding from Seagate Technology equals $310,000 for research in coherently-controlled ultrafast magnetic fields for switching magnetic recording media.

Endowed Chairs Dr. Charles Smith and Dr. John Lemasters were instrumental in obtaining an NIH grant for the **CoEE in Cancer Drug Discovery** to support the purchase of a $230,000 shared novel biosensor instrument called a "Seahorse." For FY 2007, the CoEE had over $3.7 million in sponsored federal funding. As more researchers are added to the CoEE, funding is expected to increase by eight to ten percent annually over the next five years.

The **CoEE in Brain Imaging** launched a spin-off company, Cephos Corporation, which uses brain imaging technology to detect deception. Cephos has opened a small Charleston office and expects to market its technology in Spring 2008. The CoEE continues to work with Philips Research Scientists, which has decided to launch a research initiative in brain imaging and stimulation. A partnership has been formed with Ladson-based Force Protection Industries, a major Charleston area employer. As a leading manufacturer of tanks and armored vehicles, this company will utilize CoEE research in the prevention of traumatic brain injury due to combat explosions. Companies including Glaxo-Smith Kline, Jazz Pharmaceuticals, and BioValve are using the CoEE's imaging facilities and personnel to speed drug discovery and development in anticonvulsants, mood stabilizers, and cognitive enhancers. The Center was also successful in launching the McCausland Imaging Center in Columbia. Most recently, the CoEE has launched the Center for Animal Imaging which conducts translational research in substance abuse and epilepsy therapy. Current federal funding is in excess of $10 million; a Department of Defense proposal regarding the study of traumatic brain injury in combat troops is currently being submitted for $37 million.

Clemson's Center for Optical Materials Science and Engineering Technologies (COMSET), of which the **CoEE in Optical Materials** is an integral component, receives constant visits from private sector representatives due to the fiber fabrication infrastructure and expert research activity . With this Endowed Chair, the CoEE is expected to continue and increase to economic impact. This CoEE has had an indirect impact on the launching of two spin-off companies: Advanced Photonic Crystals, which expects to have products on the market in 2008, and Tetramer Technologies, which earned more than $1 million in revenues in 2006. These companies have been awarded 17 Small Business Innovation Research Grant Awards.

Endowed chair-holder Dr. Kenneth Tew has established a mutual program between the **CoEE in Translational Cancer Therapeutics** and Novelos Pharmaceuticals. This partnership has produced a translational research effort in the arenas of lung and ovarian cancer. The company has awarded MUSC an unrestricted grant of $220,000 for continued research, with grant renewal anticipated in FY 2008. In addition, a Small Business Technology Transfer grant application was submitted to the National Cancer Institute. Current federal funding for this CoEE totals over $450,000. This CoEE also recently co-hosted the Hollings Cancer Center Spring Symposium in Cancer Drug Discovery and Development, which was attended by a tableau of international pharmaceutical and medical experts and representatives.

The **CoEE in Polymer Nanocomposites** has received a $901,000 grant from the U.S. Air Force Research Laboratory to construct and evaluate polymer nanocomposite structures for application as high energy storage devices. Michelin has provided research funding, totaling $85,600, in the area of covalently modified organo platelet materials for use in rubber based nanocomposites. Relationships have been formed with more than 20 manufacturers, plastic processors and end-use fabricators. This CoEE is currently receiving funding from two companies and is in negotiation to receive funding from two more companies. The CoEE has also applied for two U.S. non-provisional patents and one international patent regarding its work with polymers.

The **CoEE in Hydrogen and Fuel Cell Economy and the CoEE in Renewable Fuels for the Fuel Cell Economy** work with public and private sector alliances such as the South Carolina Hydrogen and Fuel Cell Alliance and the Greater Columbia Fuel Cell Collaborative. These CoEEs help to increase dues-paying members for the Fuel Cell Center, the only NSF-funded Industry/University Cooperative Research Center for Fuels (I/UCRC). The CoEEs have ongoing collaborations with the Korea Institute of Energy Research and the Fraunhofer Institute for Solar Energy in Germany. Along with these two international collaborations, the CoEEs have 20 additional industrial partners nationally through the CFC. One startup company, Palmetto Fuel Cell Technologies, has been created through associated work of these CoEEs. It serves the industry with hardware, designs, technologies and component products. Six spin-off companies have been created through associated work of these CoEEs. ZDD, Inc. focuses on water purification processes. R&H Associates' objective is the design and development of cost-effective experiments for educational and training purposes. Palmetto Fuel Cell Analysis & Design provides advanced software and consulting services to the fuel cell industry while. DEnergy LLC focuses on new technology for compact, economical storage and generation of hydrogen gas for fuel cell applications. Hydrogen Hybrid Mobility integrates the technology of the Segway and fuel cell and hydrogen fuel canisters. AlphaPore, Inc. is a membrane modification company serving the fuel cell industry. In the past fiscal year, the CoEEs obtained a U.S. patent entitled *Method and System for Improving the Performance of a Fuel Cell.* The CoEEs also formally presented eight scientific disclosures, filed ten U.S. provisional patent applications, two U.S. non-provisional patents and two international patent applications.

The **CoEE in Travel and Tourism Technology** hopes to collaborate with major corporations to secure tourism contracts around the world. This Center is building international collaborations, including Ministers of Tourism in countries such as China, Uruquay, Guatemala and Brazil. In November 2006, faculty traveled to Uruguay to meet with the Minister of Tourism and individuals from Uruguay's leading university to develop ongoing collaborations with faculty at this university.

In 2006-07, the Vision Research Center, with which the **CoEE in Vision Science** is associated, obtained research contracts totaling over $450,000 from the following companies: Inotek Pharmaceuticals, Alcon Labs, Cara Therapeutics, Inc., AMO, OSI Pharmaceuticals, Bausch & Lomb, and Pfizer. Additionally, federal and foundational funding for the year totaled over $2.4 million from 16 grants.

The **CoEE in Supply Chain Optimization and Logistics** has received sponsored research funding from Southern Company, Michelin and Lockheed Martin. Clemson has also secured Center funding from the NSF for the creation of an Industry University Cooperative Research Center. Additional discussions regarding research funding are in process with Aerospace Engineering, IntelliTrans Solution, Alabama Power and Electric, and AGS Resources.

The **CoEE in Advanced Fiber-Based Materials** is pursuing leads with Dow Chemical and DuPont for potential support of the Center's research and endowed chair.

The **CoEE in Molecular Proteomics in Cardiovascular Disease Prevention and Treatment** is in early discussions with a company to fund its concept for a biomarker testing system. This device is envisioned as a desktop, office instrumentation which will simply and inexpensively measure protein markers to create individualized risk profiles for development of chronic heart failure. This Center has potential to yield high economic impact in the short-term. The CoEE has received $950,000 from Ortho Clinical Diagnostics through a research contract.

The **CoEE in Childhood Neurotherapeutics** has received funding from the National Institutes of Health for a clinical study in treatment of mothers with chorioamnionitis, inflammation of the amniotic membranes caused by infection. The Federal Drug Administration has awarded a grant to MUSC and the Children's Hospital of Philadelphia to evaluate the efficacy of atorvastatin, an HMG CoA reductase inhibitor, for patients with type 1 diabetes. These studies have prompted the start of a spin-off company, ImmunoMod, which develops drugs for treatment of diabetes. The CoEE has been granted two U.S. patents and has submitted three more U.S. patent applications and three international patent applications.

The Air Force Office of Scientific Research is funding research at the **Solid Oxide Fuel Cell CoEE** regarding large-scale progressive damage in structural composites for aircraft applications for $300,000. Also, Exxon Mobil/Yokohama awarded the CoEE with $200,000 to study cold temperature fatigue of inner liner materials. The CoEE has developed collaborations with the Savannah River National Laboratory and the NASA Glenn Research Center.

CoEE Review Board member and AT&T South Carolina President Pamela Lackey (left), shares the CoEE Program's economic successes with S.C. Representative Leon Howard (right).

CoEE Technology Transfer Data: 2003-2007

CoEE Name	CoEE Award Date	Chairs Approved	Chairs Hired	Center Expenditures*	Invention Disclosures	Provisional U.S. Patents Applications	U.S. Patent Applications	U.S. Patents Issued	Int'l. Patent Applications	Int'l. Patents Issued	Active Licenses	Licenses & Options Executed	Spin-Off Comp.†
Automotive Systems Integration	2002-03	1	1	$8,408,198	0	0	0	0	0	0	0	0	0
Automotive Manufacturing	2002-03	1	1	$9,361,689	0	0	0	0	0	0	0	0	0
Nanostructures	2002-03	1	1	$4,920,553	3	0	0	0	0	0	0	0	0
Brain Imaging	2002-03	4		$5,366,593	6	3	3	0	1	0	0	0	1
Proteomics	2002-03	1		$1,262,575	9	4	3	1	0	0	0	0	0
Neuroscience	2002-03	3	2	$2,212,427	0	0	0	0	0	0	0	0	1
Marine Genomics	2002-03	2		$8,088,858	8	6	5	0	5	0	0	0	0
Automotive Design & Development	2003-04	1	1	$8,631,321	0	0	0	0	0	0	0	2	0
Electronics Systems Integration	2003-04	1		$8,566,820	0	0	0	0	0	0	0	0	0
Photonic Materials	2003-04	1		$4,988,660	8	0	0	0	0	0	0	0	0
Polymer Nanocomposites	2003-04	1		$1,198,920	0	0	1	3	0	0	2	0	0
Hydrogen & Fuel Cell Economy **	2003-04	2		$3,418,799	8	10	2	1	2	0	0	0	2
Regenerative Medicine	2003-04	3	1	$1,844,153	0	0	0	0	0	0	0	0	0
Translational Cancer Therapeutics	2003-04	2	1	$3,256,269	0	0	0	0	0	0	0	0	6
Renewable Fuel Cells for Fuel Cell Economy **	2004-05	1		$918,591	0	0	0	0	0	0	0	0	1
Travel & Tourism	2004-05	1		$5,000	0	0	0	0	0	0	0	0	0
Gastrointestinal Cancer Diagnostics	2004-05	1		$119,974	12	5	4	0	2	0	0	0	0
Cancer Drug Discovery	2004-05	4	2	$5,130,693	3	3	1	0	0	0	0	0	0
Vision Science	2004-05	3		$905,342	2	0	0	0	0	0	0	0	0
Supply Chain Optimization & Logistics	2005-06	1		$0	0	0	0	0	0	0	0	0	0
Urban Ecology & Restoration	2005-06	1		$0	0	0	0	0	0	0	0	0	0
Advanced Fiber-Based Materials	2005-06	1		$0	0	0	0	0	0	0	0	0	0
Molecular Nutrition	2005-06	1		$0	0	0	0	0	0	0	0	0	0
Solid Oxide Fuel Cells	2005-06	1		$0	0	0	0	0	0	0	0	0	0
Childhood Neurotherapeutics	2005-06	3		$2,506,000	0	0	0	0	0	0	0	0	0
Molecular Proteomics in CV Disease & Prevention	2005-06	2		$0	8	4	6	2	10	0	0	0	0
Clinical Effectiveness & Patient Safety	2005-06	3	1	$120,000	3	2	2	0	2	0	4	4	1
Health Facilities Design and Testing	2006-07	2		$1,692,004	0	0	0	0	0	0	2	2	0
Rehabilitation and Reconstruction Sciences	2006-07	1		$0	0	0	0	0	0	0	0	0	0
Strategic Appr. to Electricity Prod. from Coal	2006-07	1		$0	0	0	0	0	0	0	0	0	0
Healthcare Quality	2006-07	2		$0	0	0	0	0	0	0	0	0	0
SeniorSMART™ Center	2006-07	3		$0	0	0	0	0	0	0	0	0	0
Tobacco-Related Malignancy	2006-07	2		$0	0	0	0	0	0	0	0	0	0
Stroke	2006-07	3		$311	1	0	0	0	0	0	0	0	0
TOTALS		61	11	$68,683,754.11	71	37	29	7	33	0	6	6	11

NOTE: INFORMATION CURRENT THROUGH JUNE 30, 2007.

* This represents all expenditures including institutional investment.

** Technology transfer achievements for Hydrogen & Fuel Cell Economy CoEE and Renewable Fuel Cells for Fuel Cell Economy are grouped together in 2006-2007 institutional annual reports.

† A spin-off company is defined as a new or relatively new enterprise in which an institution has a revenue-based relationship via the licensure of an invention, the development of a technology/invention or the provision of service using institutional-derived expertise. This differs from a start-up company, in that while the enterprise may have a similar business model or goals to a spin-off company, the institution does not presently maintain a revenue-based relationship (although other major relationships are likely to exist, such as space sharing or leasing, the employment or internship of graduate students, etc.).

Detailed Summary of CoEE Technology Transfer (2003-2007)

[Note: Fiscal agent listed first in parenthesis.]

Nanostructures CoEE (USC)

Invention Disclosures

- *Reprogrammable Parallel Nanomanufacturing* (utility application filed)
- *Spintronic Chemical Sensor* (utility application filed)
- *Novel Method for Chemical and Bio-molecular Sensors Using a Microcantilever-based System* (application filed)

Brain Imaging CoEE (USC/MUSC)

Invention Disclosures

- *Using Interleaved TMS/fMRI to Detect Regional Brain Effects of CNS Active Compounds*
- *Using Ampakine Compounds to Mitigate the Cognitive Deficits Caused by ECT or Other Forms of Brain Stimulation or Brain Surgery*
- *Systems for Using Psychophysiological Responses to Determine the Optimum VNS Dose for Individual Patients (Including a method for rapidly determining TMS MT)*
- *Extending the Uses and Power of Brain Stimulation with the Techniques of Classical Conditioning*
- *The Use of Transcrannial Magnetic Stimuation (TMS) for the Treatment of Acute Surgical Pain and Chronic Pain Syndromes*
- *Transcranial Magnetic Stimulation (TMS) for Improving the Accuracy of Motor Cortex Stimulator Placement in Neurosurgery*

U.S. Provisional Patent Applications

- *Methods and Systems for Using Psychophysiological Responses to Determine the Optimum VNS Dose for Individual Patients and Method and System for Rapidly*
- *Determining TMS MT Methods and Devices for the Treatment of Surgical and Chronic Pain with Transcranial Magnetic Stimuation (TMS)*
- *System and Methods for Measuring Effects of Central Nervous System Active Compounds*

U.S. Patent Applications

- *Methods and Systems For Using Transcranial Magnetic Stimulation and Functional Brain Mapping For Examining Cortical Sensitivity, Brain Communication, and Effects of Medication*
- *Methods and Systems For Using Psychophysiological Responses To Determine the Optimum VNS Dose For Individual Patients and Method and System for Rapidly Determining TMS MT*
- *Methods and Systems For Using Psychophysiological Responses To Determine the Optimum VNS Dose For Individual Patients and Method and System For Rapidly Determining TMS MT (Continuation In-Part "CIP")*

CoEE Technology Transfer Summary (cont'd)

Brain Imaging CoEE (cont'd)

International Patent Applications

- *Methods and Systems for Using Psychophysiological Responses to Determine the Optimum VNS Dose for Individual Patients and Method and System for Rapidly Determining TMS MT*

Spinoff Companies

- Cephos Corporation

Proteomics CoEE (MUSC)

Invention Disclosures

- *Novel Method for Removing Abundant Proteins in Proteomic Analysis (filed)*
- *Novel Method for Interconnecting Microfluidic Devices (filed)*
- *Electrospray Ionization From Pointed Fibers*
- *Fingertip Stylus for Personal Data Devices*
- *Monolithic chromatography column array/fraction collection device*
- *Carbon Conductors for Polymeric Microfluidic Devices*
- *Nanostructered Surfaces As a Dual Ionization LDI-DESI Platform for Increased Peptide Coverage In Shotgun Proteomic Analysis*
- *Peptoid Diversity Libraries for Use in Concentrating Low Concentration Analytes in Samples and for Removing Low Concentration Impurities in the Purification of Proteins*
- *Fluidic Interconnection System for Microfluidic Devices*

U.S. Provisional Patent Applications

- *Nanostructured Surfaces as a Dual Ionization LDI-DESI Platform for Increase Peptide Coverage in Proteomic Analysis (filed)*
- *Electrospray Ionization Using Pointed Fibers*
- *Planar Electrical Conductors and Processes and Methods for Making Planar Electrical Conductors on Plastic Surfaces*
- *Protein Identification Algorithm for Intact Protein Tandem Mass Spectrometry Data*

U.S. Patent Applications

- *Electrospray Ionization Using Pointed Fibers (issued)*
- *Coplanar Electrical Conductors and Processes and Methods For Producing Same*
- *Nanostructured Surfaces As a Dual Ionization LDI-DESI Platform for Increased Peptide Coverage In Proteomic Analysis*

U.S. Patent Issued

- *Electrospray Ionization from Pointed Fibers* (issued, attempting to license)

Neuroscience CoEE (MUSC)

Startup Companies

- SemiAlloGen, Inc.

CoEE Technology Transfer Summary (cont'd)

Marine Genomics CoEE (MUSC/College of Charleston)

Invention Disclosures

- *Use of double stranded RNA genetic interference for disease control in crustaceans*
- *Use of Double Stranded RNA To Induce Antiviral Immunity In Marine Crustacea*
- *Systems for delivery of double stranded RNA to protect marine crustacea against infectious disease*
- *Yeast-based delivery of double stranded RNA to protect marine crustacea against infectious disease*
- *Monoclonal Antibodies Reactive to WSSV*
- *Use of Chitin and Derivatives For the Oral Delivery of Double-Stranded RNA*
- *Use of Long Double-Stranded RNA (dsRNA) To Protect Vertebrate Animals from Infectious Disease*
- *Identification of an Algal Toxin for Potential Anti-Cancer Applications*

U.S. Provisional Patent Applications

- *Methods and Compositions For Inducing Non-Specific and Specific Immune Response in Crustaceans and Other Invertebrates (60/498,603)*
- *Methods and Compositions For Inducing Non-Specific and Specific Immune Responses in Crustaceans and Other Invertebrates (60/505,714)*
- *Use of Chitin and Derivatives For the Oral Delivery of Double-Stranded RNA*
- *Methods and Compositions for Inducing Non-Specific and Specific Immune Responses in Crustaceans and other Invertebrates (60/564,295)*
- *Use of double stranded RNA genetic interference for disease control in invertebrates*
- *Use of Algal Toxin Compounds For Anti-Cancer Therapy*

U.S. Patent Applications

- *Methods and Compositions For Inducing Non-Specific and Specific Immune Response in Crustaceans and Other Invertebrates (60/498,603)*
- *Methods and Compositions For Inducing Non-Specific and Specific Immune Responses in Crustaceans and Other Invertebrates (60/505,714)*
- *Use of Chitin and Derivatives For the Oral Delivery of Double-Stranded RNA*
- *Methods and Compositions for Inducing Non-Specific and Specific Immune Responses in Crustaceans and other Invertebrates (60/564,295)*
- *Use of double stranded RNA genetic interference for disease control in invertebrates*

International Patent Applications

- *dsRNA Induced Specific and Non-Specific Immunity in Crustaceans and Other Invertebrate sand Biodelivery Vehicles For Use Therein*

Licenses & Options Executed

- *Methods and Compositions For Inducing Non-Specific and Specific Immune Response in Crustaceans and Other Invertebrates (60/498,603)* (This technology was licensed 2 times, and is about to be licensed for a third time.)

License Income Received

$145,025 –attributable to two licenses cited above

CoEE Technology Transfer Summary (cont'd)

Photonic Materials CoEE (Clemson)

Disclosures
- Eight others in pre-filing status

U.S. Patent Applications
- *Core-Shell Nanoparticles for Controlled Energy Transfer Between Rare Earth Dopants* (filed)

U.S. Patents Issued
- *Optical Fiber Amplifier with Fully Integrated Pump Source*
- *Photon-Plasmon Coupled Optical Devices* (issued in 2006 & 2007)

Active Licenses and License Income Received
Tetramer Technologies, LLC – Research License $3,500
Unidym - License Agreement – $40,000

Spinoff Companies
- Advanced Photonics
- Tetramer Technologies

Polymer Nanocomposites CoEE (USC)

U.S. Patent Applications
- *Polymer Composite Materials Containing Synthetic Oxide Particles and Process for Producing Same* (filed)
- *Process for Creating Composite Materials to Produce Polymer Nanocomposite Films that Exhibit Improved Light Fastness Properties*

International Patent Application
- *Polymer Composites Containing Exfoliated Phosphonate or Synthetic Oxide Particles* (filed)

Hydrogen and Fuel Cell Economy CoEE & Renewable Fuels for Fuel Cell Economy CoEE[1] (USC)

Invention Disclosures
- *Bimetallic Cluster Derived Electrocatalysts* (pending)
- *Compact Storage and Reaction System for Hydrogen Fuel Source* (pending)
- *Pulse Electrodeposition of Platinum for PEMFC Electrodes using Wetting Agent* (pending)
- *Powering Segway Human Transporter Using Hydrogen Fuel Cells* (pending)
- *Reversible Hydrogen Storage Materials*(active PPA)
- *Highly Active and Stable Carbon-Based Electrocatalysts for Proton Exchange Membrane Fuel Cells* (combined with other technology)
- *Hydrogen from Hot Chemical Hydride Solution* (pending)
- *Heavy Reflux Pressure Swing Adsorption Cycles* (pending)

[1] Achievements for both centers are listed together in institutional annual reports.

CoEE Technology Transfer Summary (cont'd)

Hydrogen and Fuel Cell Economy & Renewable Fuels for Fuel Cell Economy (cont'd)

U.S. Provisional Patents

- *Multiphase, Thermally Integrated Hydrogen Fuel Source* (filed)
- *Steam Hydrolysis of Chemical Hydride to Produce Hydrogen* (filed)
- *Compact Hydride Device for Hydrogen Production* (filed)
- *Sub-stack Module Design for Hydrogen Fuel Cells* (filed)
- *Novel Metal-Free Catalysts for PEM Fuel Cells* (filed)
- *Novel Electrocatalyst Support and Catalyst Supported Thereon* (filed)
- *Solar Power Generation Apparatus and Maximum Power Point Tracking Method* (filed)
- *Bimetallic Cluster Derived Electrocatalysts* (filed)
- *Reversible Hydrogen Storage Materials* (filed)
- *Reversible Hydrogen Storage Materials* (filed)

U.S. Patent Applications

- *Apparatus and Method for Enhanced Solar Power Generation and Maximum Power Point Tracking* (filed)
- *Composite Catalysts Supported on Carbon Substrates and Methods of Making the Same* (filed)

U.S. Patent Issued

- *Method and System for Improving the Performance of a Fuel Cell* (issued)

International Patents

- *Polypyrrole and Silver Vanadium Oxide Composite* (filed)
- *Improved Catalysts for PEM Fuel Cell Applications Using Electroless Deposition* (filed)

Spin-off Companies

- ZDD, Inc.
- R&H Associates
- Palmetto Fuel Cell Analysis & Design
- AlphaPore, Inc.
- DEnergy LLC
- Hydrogen Hybrid Mobility

Startup Companies

- Palmetto Fuel Cell Technologies

Regenerative Medicine CoEE (MUSC/Clemson/USC)

Spin-off Companies

- First String

Gastrointestinal Cancer Diagnostics CoEE (MUSC)

Invention Disclosures

- *Use of the KS1/4 Gene For Detection and/or Diagnosis of Lung Cancer*
- *Use of the KS1/4 Gene for Detection and/or Diagnosis of Epithelial Cancers Excluding Lung*
- *Use of gene-specific priming for reverse transcription of RNA into DNA*
- *Use of a Six-Gene Marker Panel For the Detection of Esophageal Cancer*
- *Development of a Quantitative Multi-Tiered Algorithm For Discrimination of Benign and Malignant Disease*
- *Use of the XAG Gene For Detection of Metastatic Breast, Lung, and Pancreatic Cancer in Lymph Nodes*
- *A Multimarker Gene Panel For Detection of Metastatic Disease In Epithelial-Derived Cancers*
- *Molecular Discrimination of Pancreatic Cancer From Pancreatitis*
- *A Molecular Based Two-Marker Assay that Predicts Outcome of Adenocarcinoma Patients*
- *A Molecular-Based Two Marker Assay that Predicts the Outcome of Squamous Carcinoma Patients*
- *Use of EpCAM2 for Detection of Prostate Cancer Cells*
- *Molecular Prognostic Assay for Colon Cancer Using Spint2 and/or E-cadherin*

U.S. Provisional Patent Applications

- *Methods and Compositions for Diagnosing Epithelial Cell Cancer*
- *Enhanced Detection of RNA Using a Panel of Truncated Gene-Specific Primers for Reverse Transcription*
- *Methods For the Detection and Treatment of Cancer (60/777,402)*
- *Methods For the Detection and Treatment of Cancer (60/784,009)*
- *A Molecular Based Two-Marker Assay that Predicts Outcome of Adenocarcinoma Patients*

U.S. Patent Applications

- *Methods and Compositions for Diagnosing Epithelial Cell Cancer*
- *Methods For The Detection and Treatment of Cancer*
- *Molecular Based Two-Marker Assays That Predict Outcome Of Adenocarcinoma Patients*
- *Enhanced Detection Of RNA Using Panel Of Truncated Gene-Specific Primers For Reverse Transcription*

International Patent Applications

- *Methods and Compositions for Diagnosing Epithelial Cell Cancer*
- *Enhanced Detection of RNA Using a Panel of Truncated Gene-Specific Primers For Reverse Transcription*

CoEE Technology Transfer Summary (cont'd)

Cancer Drug Discovery CoEE (MUSC/USC)

Invention Disclosures

- *Cell Repair and Regeneration By Suramin and Related Polysulfonated Naphthylureas*
- *7-hydroxy-4H-chromen-4-one Derivaties Promote Mitochondrial Biogenesis*
- *Identification and Optimization of a Selective Inhibitor of Calpain 10*

U.S. Provisional Patent Applications

- *Cell Repair and Regeneration By Suramin and Related Polysulfonated Naphthylureas*
- *Modulators Of Mitochondrial Biogenesis*
- *Calpain 10 Inhibitors and Uses Thereof*

U.S. Patent Applications

- *Cell Repair and Regeneration by Suramin and Related Polysulfonated Naphthylureas*

Vision Science CoEE (MUSC/USC)

Invention Disclosures

- *Pharmacological Enhancement of the Natriuretic Peptide Systems within the Eye*
- *Dual Specific Phosphatases in Glaucoma*

Childhood Neurotherapeutics CoEE (USC/MUSC)

Invention Disclosures

- *Combination therapy of lovastatin (as an inhibitor of HMG- COA reductase) and AICAR (as an activator of AMP activated Protein Kinase) for inflammatory diseases including disorders of NO (from iNOS) and cytokines*
- *AICAR activates proapoptic pathway in breast cancer cells*
- *Attenuation of Ischemia/Reperfusion Injury*
- *Methods and Compositions For the Prevention and Treatment of Inflammatory Diseases or Conditions*
- *Method for prevention and treatment of inflammatory disease and disease conditions with inhibitors of glucosyl - and galctosyltransferase inhibitors for the synthesis of lactosylceramide and compound that increase intracellular cAMP*
- *Anti inflammatory and insulin therapy for Diabetes*
- *Lovastatin Restores Remyelination Process In EAE*
- *Methods of Treating TH-1Cell Mediated Autoimmune Diseases*

U.S. Provisional Patent Applications

- *Methods For Treating Inflammatory Disorders*
- *Methods of Treating TH-1Cell Mediated Autoimmune Diseases*
- *Methods and Compositions For the Prevention and Treatment of Inflammatory Diseases or Conditions*
- *Lovastatin Restores Remyelination Process In EAE*

Childhood Neurotherapeutics CoEE (cont'd)

U.S. Patent Applications

- *Dopamine Receptor Agonists in the Treatment and Prevention of HIV-induced Dementia* (filed)
- *Use of Dopamine D3 Receptor Antagonists in the Treatment of Neurological Disorders* (filed)
- *Attenuation of Ischemial Reperfusion Injury* (filed)
- *Methods of Treating Juvenile Type 1 Diabetes Mellitus*
- *Methods for Treating Inflammatory Disorders*
- *Protection of Transplanted Stem Cells with HMG-CoA Reductase Inhibitors*

U.S. Patents Issued

- *Methods of Treating Nitric Oxide and Cytokine Mediated Disorders* (issued)
- *Compounds for Reducing Ischemial Reperfusion Injury* (issued)

International Patent Applications

- *Dopamine Receptor Agonists in the Treatment and Prevention of HIV-Induced Dementia* (filed)
- *Attenuation of Ischemial Reperfusion Injury* (filed)
- *Methods and Compositions for the Prevention and Treatment of Inflammatory Diseases or Conditions* (filed)

Active Licenses and Options Executed

- *Attenuation of Ischemia/Reperfusion Injury*
- *Methods and Compositions For the Prevention and Treatment of Inflammatory Diseases or Conditions* (licensed to two companies)
- *Method for prevention and treatment of inflammatory disease and disease conditions with inhibitors of glucosyl - and galctosyltransferase inhibitors for the synthesis of lactosylceramide and compound that increase intracellular cAMP*

License Income Received

- $25,000

Spin-off Companies

- ImmunoMod

Molecular Proteomics in Cardiovascular Disease and Prevention CoEE (MUSC)

Invention Disclosures

- *Predicting Heart Failure Risk and Presence In Patients Following Myocardial Infarction By Protease and Protease Inhibitor Profiling*
- *Detecting Diastolic Heart Failure By Protease And Protease Inhibitor Plasma Profiling*
- *Hypertrophic Non-Failure Mouse Model*

CoEE Technology Transfer Summary (cont'd)

Molecular Proteomics in Cardiovascular Disease and Prevention CoEE (cont'd)

Provisional U.S. Patent Applications

- *Detecting Diastolic Heart Failure By Protease And Protease Inhibitor Plasma Profiling*
- *Predicting Heart Failure Following Myocardial Infarction By Protease and Protease Inhibitor Profiling*

U.S. Patent Applications

- *Detecting Diastolic Heart Failure By Protease And Protease Inhibitor Plasma Profiling*
- *Predicting Heart Failure Following Myocardial Infarction By Protease And Protease Inhibitor Profiling*

International Patent Applications

- *Predicting Heart Failure Following Myocardial Infarction by Protease and Protease Inhibitor Profiling* (PCT)
- *Detecting Diastolic Heart Failure by Protease and Protease Inhibitor Plasma Profiling* (PCT)

Active Licenses & Options Executed

- *two licenses for the detection of cardiovascular diseases in humans* [formal names protected by confidentiality agreements]

Tobacco-Related Malignancy CoEE (MUSC)

Invention Disclosures

- *PC3 Cell Lines Overexpressing Pim1, Pim2, and PIM K/A and Mammalian Expression Vector for Pim2*

VI. Program Academic Achievements

Improving the state's knowledge base and economy is not the only byproduct of CoEE research. Major indirect contributions of the CoEE Program include the education, training and scholarly output of students, especially graduate students, and other faculty members or research partners working in conjunction with the CoEE endowed chairs. By mandate of the CoEE Review Board, each CoEE must be supported by affiliated graduate programs. As the research conducted at each CoEE gradually builds the reputation of each affiliate graduate program, it becomes easier to recruit, nationally and internationally, the very best students and postdoctoral researchers in each CoEE field. As industry builds around each CoEE and CoEE cluster, students and faculty members are likely to remain in state and continue building the state's knowledge economy. Listed below are some academic achievements which have resulted from the CoEE Program:

The **CoEE endowed chairs in Automotive Manufacturing** and **Automotive Design and Development** have developed and refined the M.S. and Ph.D. graduate program in Automotive Engineering. (This is the first automotive engineering doctoral program offered in the country.) The curriculum was finalized in this past academic year. The **CoEE endowed chair in Vehicle Electronic Systems Integration** proposed two courses for the new automotive engineering curriculum: Introduction to Automotive Electronic Systems and Automotive Electronics Design. The program changes have been approved by CHE and the Southern Association of Colleges and Schools (SACS). The first doctoral students under the refined programs were admitted in August 2006, and the first classes were held in August 2007. In October 2004, faculty involved with CU-ICAR presented research results at the S.C. Endowed Matches for Business Excellence Recruitment Conference in order to promote research collaboration among other state institutions. During FY 2007, **the three CoEE chairs at CU-ICAR** published a total of 29 academic, peer-reviewed papers.

The **CoEE in Neuroscience** strengthens MUSC's partnerships with Clemson and USC in the areas of bioengineering, stem cell research and drug discovery. In collaboration with the Neuroscience Institute, this CoEE provides the following education opportunities: Brain Awareness Week (for elementary and middle school students), Frontier in Neuroscience (an opportunity for students, post-docs, and faculty to interact with internationally-renown neuroscientists), the Georgia/South Carolina Neuroscience Consortium, Grand Rounds (seminar programs which highlight translational research), and the Summer Undergraduate Research Program. **CoEE chair Dr. Gary Aston-Jones** was a featured speaker at the North American Association for the Study of Obesity meeting in Boston, at the Okinawa Institute of Science Workshop on Cognitive Neurobiology in Japan and at the Eleventh International Conference on Cognitive and Neural Systems in Boston. **CoEE chair Dr. Miguel Pappolla** served as a member of the initial review board for the Alzheimer's Association-Nancy Reagan Foundation and as an invited guest editor for the *Journal of Alzheimer's Research*. In FY 2007, **chairs Aston-Jones and Pappolla** produced 11 published works. Currently, five graduate students and five post-doctoral students are associated with the CoEE.

The **CoEE in Marine Genomics** has created a new Marine Genomics track in the program leading to the M.S. degree in Marine Biology at the College of Charleston. This track complements a highly innovative undergraduate degree program in Discovery Informatics at the College of Charleston. In May 2005, MUSC and NSF held an international workshop in Charleston on marine genomics which resulted in several scientific collaborations. In June 2005, NSF sponsored a genomics workshop on the organism *Fundulus* at the Hollings Lab in Charleston. In the past year, the College of Charleston has committed funds to support up to four graduate fellowships per year in Marine Genomics. This commitment enables recruitment of nationally outstanding students to the Graduate Program in Marine Biology (GPMB) which acts as a strong "feeder" program for doctoral study in Marine Biomedicine and Environmental Sciences (MBES) at MUSC. Both the GPMB and the MBES have added new graduate courses in Marine Genomics, Eco-genomics and Marine Molecular Ecology, with 50 graduate students participating thus far. Three recent graduates of the doctoral program at MUSC have taken positions with the FBI, the Center of Marine Biotechnology at the University of Maryland and the National Cancer Institute/Johns Hopkins School of Public Health. Also, a student with the MBES program recently won a highly competitive NSF pre-doctoral fellowship based on genomics technology applied to a marine organism. Through its work with shrimp, this CoEE has also partnered with Clemson University's Genome Institute (CUGI); this partnership and collaboration have produced two mini-symposiums and led to CoEE faculty becoming adjunct faculty at Clemson and vice versa. Also, a memorandum of understanding on global climate change was signed by Clemson, MUSC, College of Charleston and the S.C. Department of Natural Resources, providing an "umbrella focus" on the application of marine genomics technologies to global climate changes.

The **CoEE in Nanostructures** supports a research group that includes two research assistant professors, seven doctoral students, two graduate students, six undergraduate students and one high school student. **CoEE chair Dr. Richard Webb** is collaborating with the USC Department of Electrical Engineering to create a new nanofabrication laboratory for use by undergraduate and graduate students; Dr. Thomas Crawford has integrated an undergraduate nanotechnology research lab in the USC Department of Physics. A course on Molecular Biophysics is being developed. The CoEE has developed academic collaborations with scientists at fourteen national and international entities including universities, corporations and government agencies. During FY 2007 year, CoEE staff were invited to present at five international conferences. CoEE staff members also participated in eight university seminars including ones in Germany, The Netherlands and Canada, and authored a total of 19 academic publications.

The **CoEE in Brain Imaging** has been successful in recruiting junior faculty for the program at USC and MUSC. In the past three years, scientists associated with the CoEE have produced 49 publications. A Brain Imaging course for graduate and undergraduate students is currently offered at USC and MUSC. Two students with academic focus in neuroimaging techniques have received Ph.D.s in Communication Sciences, and another is currently a doctoral candidate in Psychology. Five individuals are currently conducting doctoral research. The CoEE has sponsored three international symposiums featuring scientists from Johns Hopkins University, Duke University, UCLA and the University of Arizona.

The **CoEE in Regenerative Medicine** currently supports educational activities for dozens of graduate and undergraduate students in the USC and MUSC Cell Biology and Anatomy programs, the Clemson Engineering program, and post-doctoral fellows at each of the three research universities. In FY 2007, preliminary conceptual and structural planning began for the Bioengineering Building on the MUSC campus. The South Carolina Bioengineering Alliance, which is closely affiliated with this CoEE, conducted a bioengineering summit in June 2007. The conference was attended by over 200 individuals including nine program directors from NIH and staff from the Department of Defense and NSF.

The **CoEE in Optical Materials** is a component of the larger initiative COMSET (see page 36), which received CHE approval in 2004 as the state's only optics research center. As of the FY 2007, approximately 50 graduate and 20 undergraduate students were affiliated with COMSET. Also, an interdisciplinary graduate program (M.S. and Ph.D.) in Photonics is presently being developed between COMSET and the Clemson Graduate School. The Carolina MicroOptics Triangle (CMOT) is a regional optics cluster that brings together research and economic development between Clemson, UNC-Charlotte and Western Carolina University. Nationally launched in 2006, CMOT added industrial affiliates in the past year and is recognized as one of only four university photonics clusters in the U.S. Additionally, COMSET will formalize the Carolinas Photonics Consortium which adds Duke University and N.C. State to the CMOT. The focus of these consortia is to advance the development of new optical materials, devices, and components in support of the existing photonics industry in the Carolinas.

The **CoEE in Translational Cancer Therapeutics** has successfully recruited four accomplished faculty members from the Fox Chase Cancer Center (Philadelphia), NIH, Harvard University, and the University of Virginia. During the past year, individuals associated with the CoEE have published four peer-reviewed manuscripts, five book chapters and three abstracts.

Ten post-doctoral fellows and eight graduate students were associated with the **CoEE in Cancer Drug Discovery** during FY 2007. In this same year, researchers associated with the CoEE authored 71 scientific publications.

The **CoEE in Hydrogen and Fuel Cell Economy** and the **CoEE in Renewable Fuel for the Fuel Cell Economy** have developed graduate-level courses in Electrochemistry, Mathematical Modeling, Fuel Cell Engineering, and Interfacial Engineering. Over 60 graduate students have been associated with both CoEEs over the past four years. During FY 2007, Scientists associated with these CoEEs have presented and/or exhibited at four international conferences, including a featured exhibit at the world's largest trade show for fuel cells, the Hannover Fuel Cell Fair. They also presented keynote speeches at a symposium in Stuttgart, Germany, and at the National Research Council of Canada Workshop in Vancouver. The USC Fuel Cell Center also hosted the second Annual USA-Korea Symposium on Fuel Cells and Hydrogen Technologies in Columbia in May 2007. In 2009, the National Hydrogen Association Meeting will be held in Columbia.

The **CoEE in Travel and Tourism Technology** is developing a baccalaureate degree in Tourism Management and a master's degree in Hospitality Technology Management.

The **CoEE in Polymer Nanocomposites** is currently supporting two graduate students and two undergraduates in Chemistry, with one postdoctoral student scheduled to complete her thesis in September 2007 regarding synthesis and characterization of oxide materials. Other students associated with the CoEE include three graduate students, one postdoctoral student and one undergraduate student in Engineering. In the past year, scientists associated with the CoEE have produced seven publications in the field and have been invited to present at four national and international conferences including the 20th International Conference on PET Containers for Food and Beverages.

The work of the **CoEE in Vision Science** led to the publication of 26 papers in leading ophthalmic and basic science peer-reviewed journals. Also, four graduate students, seven medical and scientific post-doctoral fellows and 21 ophthalmic residents were associated with this Center in FY 2007.

The **CoEE in Gastrointestinal Cancer Diagnostics** is in discussion with researchers at Johns Hopkins University and Duke University regarding possible research collaboration in esophageal malignancy.

The work of the **CoEE in Molecular Proteomics in Cardiovascular Disease Prevention and Treatment** led to three published papers in FY 2007.

CoEE Chair Dr. John Schaefer of the **CoEE in Clinical Effectiveness and Patient Safety** is providing academic consultation for USC Upstate and Greenville Technical College. The CoEE offered a total of 150 simulation sessions to over 450 participants through the MUSC Healthcare Simulation Center and the Greenville Healthcare Simulation Center. Simulation sessions include medical emergency team training, difficult airway management, fiber-optic bronchoscopy, pediatric simulation, emergency room residency skills, pelvic exam for sexual assault nurse examiner, and labor and delivery skill application.

Related faculty of the **CoEE in Molecular Nutrition** published 24 scientific papers in FY 2007.

VII. Centers of Economic Excellence Review Board

2002-2003

NAME	POSITION	APPOINTMENT
Margaret Addison	Member	Governor I
Harry Lightsey, Jr.*	Member	Governor II
Samuel J. Tenenbaum	Vice Chair	Governor III
Anthony O'Neill	Member	Senate President Pro Tempore I
William Amick	Member	Senate President Pro Tempore II
James Bailey	Member	Senate President Pro Tempore III
Edward T. McMullen, Jr.	Chair	Speaker of the House I
Benjamin T. Rook	Secretary	Speaker of the House II
Rita Allison**	Member	Speaker of the House III
James F. Barker	Ex-Officio	
Raymond S. Greenberg	Ex-Officio	
Andrew A. Sorensen	Ex-Officio	

* Robert W. Pearce, Jr. replaced Harry Lightsey, Jr. as a Governor appointee during FY 2002-03.
** Paula Harper Bethea replaced Rita Allison as a Speaker of the House appointee during FY 2002-03.

2003-2004

NAME	POSITION	APPOINTMENT
Margaret Addison	Member	Governor I
Robert W. Pearce, Jr.	Member	Governor II
Samuel J. Tenenbaum	Vice Chair	Governor III
Anthony O'Neill	Member	Senate President Pro Tempore I
William Amick	Member	Senate President Pro Tempore II
James Bailey	Member	Senate President Pro Tempore III
Edward T. McMullen, Jr.	Chair	Speaker of the House I
Benjamin T. Rook	Secretary	Speaker of the House II
Paula Harper-Bethea	Member	Speaker of the House III
James F. Barker	Ex-Officio	
Raymond S. Greenberg	Ex-Officio	
Andrew A. Sorensen	Ex-Officio	

2004-2005

NAME	POSITION	APPOINTMENT
John Molnar*	Member	Governor I
Robert W. Pearce, Jr.	Member	Governor II
Samuel J. Tenenbaum	Vice Chair	Governor III
Anthony O'Neill	Member	Senate President Pro Tempore I
William Amick**	Member	Senate President Pro Tempore II
James Bailey	Member	Senate President Pro Tempore III
Edward T. McMullen, Jr.	Member	Speaker of the House I
Benjamin T. Rook	Chair	Speaker of the House II
Paula Harper-Bethea	Secretary	Speaker of the House III
James F. Barker	Ex-Officio	
Raymond S. Greenberg	Ex-Officio	
Andrew A. Sorensen	Ex-Officio	

* John M. Rivers replaced John Molnar as a Governor appointee during FY 2004-05.
** Harry M. Lightsey, III replaced William Amick as a President Pro Tempore appointee during FY 2004-05.

2005-2006

NAME	POSITION	APPOINTMENT
John M. Rivers	Member	Governor I
Robert W. Pearce, Jr.	Member	Governor II
Samuel J. Tenenbaum	Vice Chair	Governor III
Anthony O'Neill	Member	Senate President Pro Tempore I
Harry M. Lightsey, III	Member	Senate President Pro Tempore II
Donald Babb	Member	Senate President Pro Tempore III
Edward T. McMullen, Jr.	Member	Speaker of the House I
Benjamin T. Rook	Chair	Speaker of the House II
Paula Harper-Bethea	Secretary	Speaker of the House III
James F. Barker	Ex-Officio	
Raymond S. Greenberg	Ex-Officio	
Andrew A. Sorensen	Ex-Officio	

2006-2007

NAME	POSITION	APPOINTMENT
John M. Rivers*	Member	Governor I
Robert W. Pearce, Jr.	Member	Governor II
Samuel J. Tenenbaum**	Member	Governor III
Anthony O'Neill***	Member	Senate President Pro Tempore I
Harry M. Lightsey, III†	Member	Senate President Pro Tempore II
Donald Babb	Vice-Chair	Senate President Pro Tempore III
Edward T. McMullen, Jr.	Member	Speaker of the House I
Benjamin T. Rook‡	Member	Speaker of the House II
Paula Harper-Bethea	Chair	Speaker of the House III
James F. Barker	Ex-Officio	
Raymond S. Greenberg	Ex-Officio	
Andrew A. Sorensen	Ex-Officio	

*Keith D. Munson replaced John M. Rivers as a Governor appointee during FY 2007.
**J. Lyles Glenn replaced Samuel J. Tenenbaum as a Governor appointee during FY 2007.
***Melvin C. Williams replaced Anthony O'Neill as a Senate President Pro Tempore appointee during FY 2007.
†Gregg F. Morton replaced Harry M. Lightsey, III as a Senate President Pro Tempore appointee during FY 2007.
‡Patricia E. Wilson replaced Benjamin T. Rook as a Speaker of the House appointee during FY 2007.

S.C. CoEE Review Board Member Biographies[1]

Paula Harper-Bethea (Chair)
Harper-Bethea is director of external relations for the McNair Law Firm. She has served as a board member and past chairwoman of the S.C. Chamber of Commerce, as chair emeritus of the United Way of America's Board of Governors, and as past chair of the United Way of S.C. She is a founding board member of the Palmetto Institute, a member of the board of the Health Sciences Foundation, and vice-chair of the Presbyterian College Board of Trustees. She is a past member of the S.C. State Ethics Commission and a recipient of The Order of the Palmetto, the state's highest award for volunteer service. She and her husband were honored as the S.C. Chamber of Commerce's 2006 Business Leaders of the Year. They reside in Hilton Head.

Donald Babb (Vice-chair)
Babb is a partner for Wind Tunnel eXtreme, based in Charlotte. He previously served as CEO of Amick Farms Inc., Jackson Companies of Myrtle Beach, and the Foster Dixiana Corporation. While at Foster Dixiana, he created Sandhills, a 350-acre, multi-use industrial park and soil remediation company. Babb serves as a director of a number of real estate firms, including Grubb & Ellis/ Wilson/Kibler; Palmetto Preservation, Inc.; and Sandhills Development Company. He attended the University of Illinois and Eastern Michigan, earning a B.S. and M.B.A. He spent six years in the U.S. Navy as a Naval Flight Officer.

Robert W. Pearce, Jr. (Secretary)
Pearce is a partner of Nelson Mullins Riley & Scarborough. His practice focus includes real estate finance, lender representation, corporate law, private securities offerings, venture capital, mergers and acquisitions, and trademark law. He has served as general counsel for the Charleston Metro Chamber of Commerce; as past local board member of BB&T Bank; as past board chairman and cofounder of ThinkTEC; and has recently been appointed to the S.C. Council of Competitiveness. Pearce was honored by the Governor in 2004 as an Economic Development Ambassador. He is the cofounder of the technology newsletter, *CyberWatch®*. Pearce has a J.D. from USC, an M.B.A. from USC, and a B.A. in Economics from Washington and Lee University.

Melvin C. Williams
Williams is the business developer of the Charleston branch of SM&E, a southeastern engineering firm. He is director at-large of the South Carolina section of the American Society of Civil Engineers and serves on the board of the American Subcontractors Association of the Carolinas. He is a member of the Charleston Civil Engineers Club, the Charleston Contractors' Association, and the Society of American Military Engineers. He is an alumnus of South Carolina State University and was recognized as a "Stellar Alumnus" in 2006.

[1] Current through June 2008.

Patricia E. Wilson

Wilson has chaired several state and local cultural organizations including the South Carolina Arts Commission, the South Carolina Arts Foundation, and the Columbia Arts Task Force. She has also served on the boards of the Columbia Museum of Art and the South Carolina State Museum. She is a member of the National Arts Society and is a recipient of the Yale University Award for Cultural Achievement.

Keith D. Munson

Munson is an attorney with Womble, Carlyle, Sandridge & Rice. He is a trial lawyer with nearly 20 years of experience. His civic activities include serving as a member/spokesperson for Governor Sanford's Transition Team; board member of the S.C. Public Service Authority (Santee Cooper); and board member of the Upstate Alliance. His military service includes serving as a U.S. Army Captain with the 24th Infantry Division during the first Persian Gulf War. He has a J.D. from the UVA Law School and a B.A. in Political Science from Clemson.

J. Lyles Glenn

Glenn is a principal with Keenan Development Associates, LLC, a real estate development firm focused on public/private partnerships. He also serves in an Of Counsel capacity with the law firm Ellis, Lawhorne and Sims, P.A. His previous positions include vice president, chief operating officer, and chief executive assistant to the president of the University of South Carolina, and he has served as executive assistant to a former lieutenant governor of South Carolina. He has a J.D. and B.A. from the University of South Carolina.

Pamela P. Lackey

Lackey is president of AT&T's S.C. operations and lives in Columbia. She has worked with BellSouth since 1997, first as sales manager for education and government markets, then as the government relations director. Before her tenure with BellSouth, she served the S. C. Department of Education as a senior executive assistant. Lackey has been active in numerous community and civic organizations, including the South Carolina Chamber of Commerce, Palmetto Center for Women Business Advisory Committee, Junior League of Greenville and Columbia, and the SCETV Midlands Citizen's Advisory Committee.

Charlie Condon

Condon runs his own law practice in Mount Pleasant with an emphasis on governmental relations, criminal defense, licensing issues, personal injury, and litigation. Condon served as S.C. Attorney General from 1995 to 2003. He has also served as Ninth Judicial Circuit Solicitor, as Assistant Solicitor in Charleston County, and as Securities Commissioner of S.C. while he was Attorney General of South Carolina. He received his J.D. from Duke University and his B.A. from Notre Dame. He is married and has four children.

VIII. CoEE Program Contact Information/Media Page

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Official CoEE Program Website:
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CoEE Review Board Meeting Materials,
including CoEE Program *Guidelines*, available at:
www.endowedchairs.org

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APPENDIX I

SOUTH CAROLINA CENTERS OF ECONOMIC EXCELLENCE PROGRAM

PROGRAM ACCOUNT REPORT [through June 30, 2007]

S.C. Centers of Economic Excellence c/o S.C. Commission on Higher Education 1333 Main St. Suite 200 Columbia, S.C. 29201
Tel: 803-737-2260 Fax: 803-737-2297 www.endowedchairs.org www.sccoee.org

South Carolina Commission on Higher Education

Lottery Endowed Chairs - S.C. Centers of Economic Excellence

Activity Summary

Inception thru FY 2007

	FY 02 - 03	FY 03 - 04	FY 04 - 05	FY 05 - 06	FY 06 - 07	Totals
Beginning Balance at July 1st	-	29,982,497.62	53,367,045.03	70,189,110.00	84,159,393.52	
Appropriations	30,000,000.00	30,000,000.00	30,000,000.00	30,000,000.00	30,000,000.00	150,000,000.00
Operating Expenditures	(33,814.38)	(183,928.16)	(202,549.41)	(107,438.26)	(413,251.86)	(940,982.07)
Cash Retained for Operations	-	-	-	-	-	-
Disbursement to Recipients	-	(7,500,000.00)	(15,072,920.00)	(19,057,247.00)	(10,940,662.00)	(52,570,829.00)
Interest Revenue	16,312.00	1,068,475.57	2,097,534.38	3,134,968.78	4,820,762.65	11,138,053.38
End Balance at Revision Date	29,982,497.62	53,367,045.03	70,189,110.00	84,159,393.52	106,363,857.31	106,363,857.31

APPENDIX II

SOUTH CAROLINA CENTERS OF ECONOMIC EXCELLENCE PROGRAM

DETAILED SUMMARY OF FUNDED CoEE PROPOSALS [through June 30, 2007]

South Carolina Centers of Economic Excellence
Summary of Funded Proposals 2003-2007

Institution(s)	Proposal	Proposal Amount	State Funds Drawn	Match Pledged	Match Received	Date of Inception	18 month pledge window	Pledge deadline met	66 month draw down window	No. of Chairs	Chair(s) Hired	Chair Holder
Funding Year 2002-03												
Clemson	Automotive Systems Integration	$5 Million	$5,000,000	$5,000,000	$5,000,000	6/24/2003	12/24/2004	yes	12/24/2009	1		
Clemson	Automotive Manufacturing	$5 Million	$5,000,000	$5,000,000	$5,000,000	6/24/2003	12/24/2004	yes	12/24/2009	1	1	Kurtoss
USC	Nanostructures	$4 Million	$2,016,700	$4,000,000	$2,016,738	6/24/2003	12/24/2004	yes	12/24/2009	1		
USC/MUSC	Brain Imaging	$5 Million	$2,970,800	$5,000,000	$2,970,896	6/24/2003	12/24/2004	yes	12/24/2009	4	1	Webb
MUSC	Proteomics	$4 Million	$800,000	$4,000,000	$800,000	6/24/2003	12/24/2004	yes	12/24/2009	1		
MUSC	Neuroscience	$3 Million	$2,400,000	$3,000,000	$2,400,881	6/24/2003	12/24/2004	yes	12/24/2009	3	2	Pappolla, Aston-Jr
MUSC/Coll of Charles.	Marine Genomics	$4 Million	$1,500,000	$4,000,000	$1,500,000	6/24/2003	12/24/2004	yes	12/24/2009	2		
	Total 2002-03	$50 Million	$19,387,500	$50,000,000	$19,388,495							
Funding Year 2003-04												
Clemson	Automotive Design & Development	$5 Million										
Clemson	Vehicle Electronics Systems	$3 Million	$2,200,000	$3,000,000	$2,200,000	6/25/2003	2/25/2005	yes	2/25/2010	1	1	Ziegert
Clemson	Optical Materials	$6 Million	$2,897,165	$6,000,000	$2,897,165	4/27/2004	10/27/2005	yes	10/27/2010	1	1	Hubing
USC	Polymer Nanocomposites					4/27/2004	10/27/2005	yes	10/27/2010	1		
USC	Hydrogen & Fuel Cell Economy (I) **	$3.5 Million	$1,866,620	$3,500,000	$1,866,900	4/27/2004	10/27/2005	yes	10/27/2010	1		
MUSC/Clemson/USC		$2.5 Million	$1,840,945	$2,500,000	$1,841,016	4/27/2004	10/27/2005	yes	10/27/2010	2		
MUSC/USC	Regenerative Medicine	$5 Million	$2,000,000	$5,000,000	$3,427,173	6/25/2003	2/25/2005	yes	2/25/2010	3	1	Swaja
	Translational Cancer Therapeutics	$5 Million	$5,000,000	$5,000,000	$5,000,000	4/27/2004	10/27/2005	yes	10/27/2010	2	1	Tew
	Total 2003-04	$29 Million	$15,804,730	$29,000,000	$22,232,256							
Funding Year 2004-05												
Clemson	Restoration [WITHDRAWN 7-11-07]	[$3 Million]				6/30/2004						
Clemson	Electron Imaging [WITHDRAWN 12-21-07]	[$5 Million]				6/29/2005						
USC	Renewable Fuel Cells for Fuel Cell Economy	$3 Million	$1,160,900	$3,000,000	$1,160,900	6/29/2005	12/29/2006	yes	12/29/2011	1		
USC	Hydrogen & Fuel Cell Economy (II) **	$2.5 Million		$2,500,000		6/30/2004	2/28/2006	yes	2/28/2011	[See 03-04]		
USC/Coastal Carolina	Travel & Tourism	$2 Million	$925,000	$2,000,000	$925,000	6/30/2004	2/28/2006	yes	2/28/2011	1		
MUSC	Gastrointestinal Cancer Diagnostics	$6 Million	$2,363,303	$5,000,000	$3,697,045	6/29/2005	12/29/2006	yes	12/29/2011	1		
MUSC/USC	Cancer Drug Discovery	$5 Million	$4,500,000	$5,000,000	$5,000,000	6/30/2004	2/28/2006	yes	2/28/2011	4	2	Lehtastara, Smith
MUSC/USC	Vision Science	$4.5 Million	$3,029,799	$4,500,000	$4,500,000	6/29/2005	12/29/2006	yes	12/29/2011	3		
	Total 2004-05	$22 Million	$11,979,002	$22,000,000	$15,282,945							

South Carolina Centers of Economic Excellence
Summary of Funded Proposals 2003-2007 [cont'd]

Institution(s)	Proposal	Proposal Amount	State Funds Drawn	Match Pledged	Match Received	Date of Inception	18 month pledge window	Pledge deadline met	60 month draw down window	No. of Chairs	Chair(s) Hired	Chair Holder
Funding Year 2005-06												
Clemson	Supply Chain Optimization & Logistics	$2 Million				9/16/2005	3/16/2007	Extension I	3/16/2012	1		
Clemson	Urban Ecology & Restoration	$2 Million				9/16/2005	3/16/2007	Extension I	3/16/2012	1		
Clemson	Advanced Fiber-Based Materials	$4 Million	$2,897,165	$2,897,165	$2,897,165	6/13/2006	12/13/2007		12/13/2012	1		
Clemson	Molecular Nutrition	$2 Million				6/13/2006	12/13/2007		12/13/2012	1		
USC	Solid Oxide Fuel Cells	$3 Million										
USC/MUSC	Childhood Neurotherapeutics	$5 Million				6/13/2006	12/13/2007		12/13/2012	1		
MUSC	Molecular Proteomics in CV Disease & Prevention	$5 Million				6/13/2006	12/13/2007		12/13/2012	3		
MUSC/USC/Clemson	Clinical Effectiveness & Patient Safety	$5 Million	$2,502,432	$5,000,000	$2,502,432	6/13/2006	12/13/2007		12/13/2012	2		
	Total 2005-06	$28 Million	$5,399,597	$7,897,165	$5,399,597	9/16/2005	3/16/2007	yes	3/16/2012	3	1	Schaefer (MUSC)
Funding Year 2006-07												
Clemson/MUSC	Health Facilities Design and Testing	$5 Million				6/18/2007	12/18/2008		12/18/2013	2		
USC	Rehabilitation and Reconstruction Sciences	$5 Million										
USC	Strategic Appr. to Electricity Prod. from Coal	$5 Million				6/18/2007	12/18/2008		12/18/2013	1		
USC/MUSC/Clemson	Health Care Quality	$5 Million				6/18/2007	12/18/2008		12/18/2013	1		
USC/Clemson	SeniorSMART Center	$5 Million				8/28/2006	2/28/2008		2/28/2013	2		
MUSC	Tobacco-Related Malignancy	$5 Million				8/20/2007	2/20/2009		2/20/2014	3		
MUSC/USC	Stroke	$5 Million				6/18/2007	12/18/2008		12/18/2013	2		
	Total 2006-07	$35 Million	$0	$0	$0	6/18/2007	12/18/2008		12/18/2013	3		
	Totals Since Program Inception	$144 Million	$52,570,829	$88,897,165	$82,303,293					61	11	
	Funds to be Awarded by CoEE Board on June 9, 2008	$36 Million										
	Total Lottery Appropriations (2003-2007):	$180 Million										

Last updated June 30, 2007

APPENDIX III

SOUTH CAROLINA CENTERS OF ECONOMIC EXCELLENCE PROGRAM

CoEE PROGRAM HIGHLIGHTS TIMELINE [through June 30, 2007]

CoEE Program Highlights Timeline

2002-2003

July 2002: Passage of South Carolina Research Centers of Economic Excellence Act (S.C. 2-75)

September 2002: BMW pledges $10 million non-state match for two CoEE chairs at CU-ICAR

October 2002: First CoEE Review Board meeting

June 2003: First cycle of CoEE proposals awarded by Review Board

2003-2004

January 2004: Dr. Kenneth Tew appointed by MUSC as first CoEE Chair (JOHN C. WEST CHAIR IN CANCER RESEARCH CoEE at Translational Cancer Therapeutics CoEE)

February 2004: Michelin pledges $3 million non-state match for Vehicle Systems Electronics Integration Chair at CU-ICAR

March 2004: USC receives $2 million non-state match pledge for Travel & Tourism CoEE

March 2004: S.C. General Assembly adds Section 90 to RCEE Act, which permits federal funds to be used as non-state matches in CoEE Program

April 2004: Establishment of Health Sciences South Carolina

April 2004: Second cycle of CoEE proposals awarded by Review Board

2004-2005

August 2004: Dr. Richard Webb appointed by USC as CoEE Chair (CoEE CHAIR IN NANOELECTRONICS at Nanostructures CoEE)

February 2005: HSSC pledges $5 million non-state match to the Brain Imaging CoEE

June 2005: Third cycle of CoEE proposals awarded by Review Board

2005-2006

August 2005: Dr. Thomas Kurfess appointed by Clemson as CoEE Chair (BMW CoEE ENDOWED CHAIR IN AUTOMOTIVE MANUFACTURING)

September 2005: BMW Information Technology Research Center opens as the first operational facility on the CU-ICAR campus

January 2006: Dr. Miguel Pappolla appointed by MUSC as CoEE Chair (JOSEPHINE TUCKER MORSE CoEE ENDOWED CHAIR IN NEUROSCIENCE at Neuroscience CoEE)

February 2006: Dr. John Lemasters appointed by MUSC as CoEE Chair (CoEE ENDOWED CHAIR IN ADVANCED TECHNOLOGIES at Cancer Drug Discovery CoEE)

February 2006: Dr. Charles Smith appointed by MUSC as CoEE Chair (CHARLES & CAROL COOPER CoEE ENDOWED CHAIR IN PHARMACY at Cancer Drug Discovery CoEE)

February 2006: Dr. John Schaefer appointed by MUSC as CoEE Chair (LEWIS BLACKMAN CoEE ENDOWED CHAIR FOR PATIENT SIMULATION AND RESEARCH FOR HEALTH SCIENCES SOUTH CAROLINA at Clinical Effectiveness and Patient Safety CoEE)

April 2006: McCausland Brain Imaging Center opens

June 2006: Fourth cycle of CoEE proposals awarded by Review Board

2006-2007

July 2006: Timken announces $3 million non-state match pledge for CoEE chair at CU-ICAR

July 2006: Dr. Gary Aston-Jones appointed by MUSC as CoEE Chair (WILLIAM H. MURRAY CoEE ENDOWED CHAIR IN NEUROPATHOLOGY at Neuroscience CoEE)

July 2006: Dr. Todd Hubing appointed by Clemson as CoEE Chair (MICHELIN CoEE ENDOWED CHAIR IN VEHICULAR ELECTRONIC SYSTEMS INTEGRATION)

August 2006: Duke Endowment awards $21 million grant to HSSC for CoEE non-state matching pledges

August 2006: Dr. John Ziegert appointed by Clemson as CoEE Chair (TIMKEN CoEE ENDOWED CHAIR IN AUTOMOTIVE DESIGN AND DEVELOPMENT)

August 2006: Hansjorg Wyss Foundation pledges $2 million non-state match to Clemson University for the Regenerative Medicine CoEE

October 2006: Dr. Richard Swaja appointed by MUSC as CoEE Chair (CoEE CHAIR IN REGENERATIVE MEDICINE at Regenerative Medicine CoEE)

October 2006: Smith & Nephew announces $5 million non-state match pledge for Rehabilitation and Reconstruction Science CoEE

October 2006: Timken Technology Center opens on the CU-ICAR campus

March 2007: Translational Cancer Therapeutics CoEE co-hosts Hollings Cancer Center Spring Symposium in Cancer Drug Discovery and Development.

June 2007: Fifth cycle of CoEE proposals awarded by Review Board

The South Carolina Centers of Economic Excellence Report to the South Carolina Budget & Control Board Report is published annually by the South Carolina Centers of Economic Excellence Review Board and the South Carolina Commission on Higher Education in accordance with S.C. 2-75-10.

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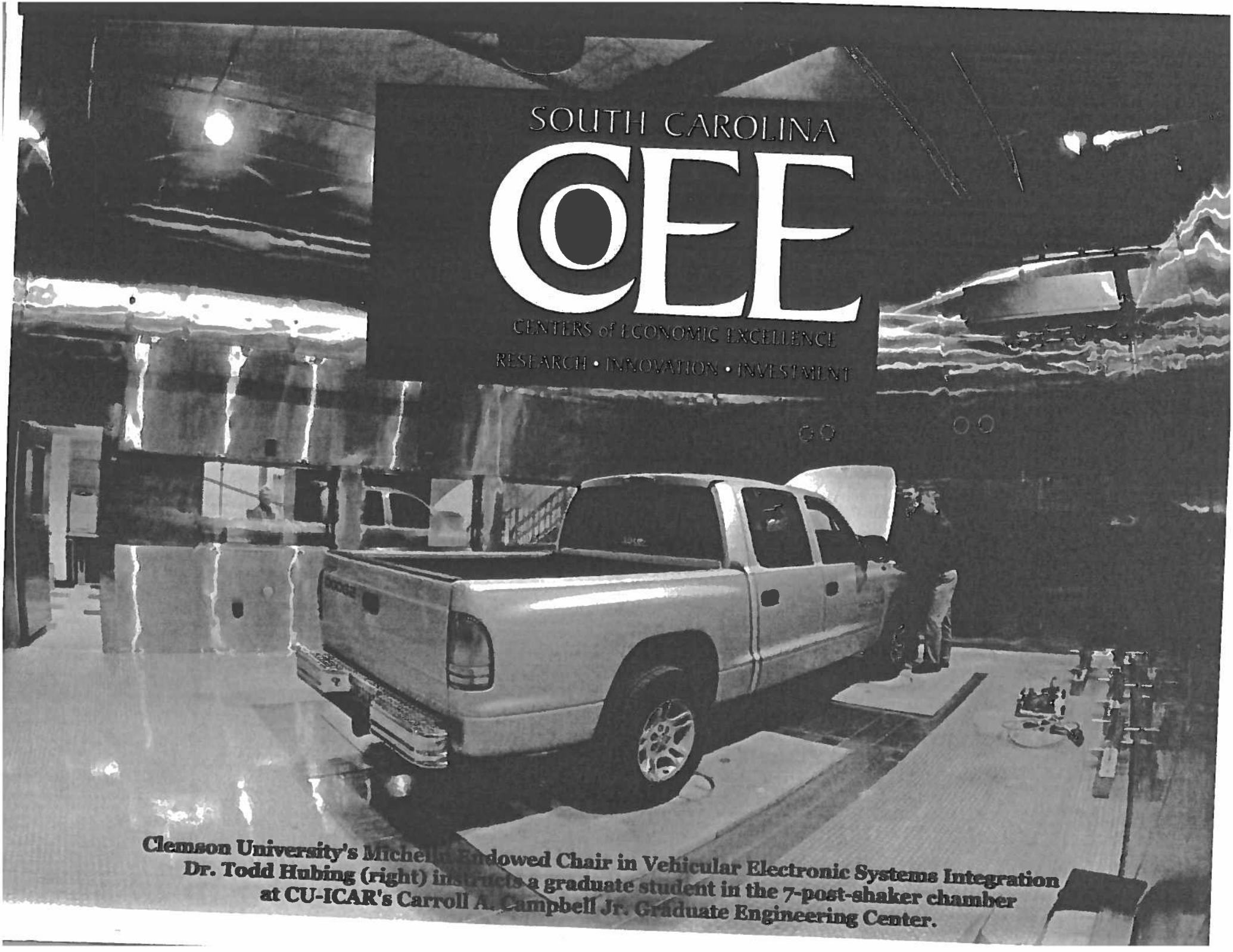

Clemson University's Michelin Endowed Chair in Vehicular Electronic Systems Integration Dr. Todd Hubing (right) instructs a graduate student in the 7-post-shaker chamber at CU-ICAR's Carroll A. Campbell Jr. Graduate Engineering Center.