THE UNIVERSITY *of* TEXAS
HEALTH SCIENCE CENTER AT HOUSTON

BROWN FOUNDATION INSTITUTE OF MOLECULAR MEDICINE
FOR THE PREVENTION OF HUMAN DISEASES

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Mauro Ferrari, Ph.D. – ETF Summary Statement 2008

Dr. Mauro Ferrari was the first recipient of a Research Superiority Award (ETF Subchapter F), which was instrumental in recruiting him to Texas in 2006.

Academic Appointments. Dr. Ferrari's primary appointment is at the University of Texas Health Science Center in Houston (UTHSC-H), where he serves as Deputy Chairman of Biomedical Engineering, Professor and Director of Nanomedicine, and tenured Professor of Internal Medicine. He is a tenured Professor of Experimental Therapeutics at the M. D. Anderson Cancer Center (MDACC - 39% time), and an Adjunct Professor of Bioengineering at Rice University (10% time). He holds non-compensated, adjunct faculty appointments at the University of Texas Medical Branch in Galveston, at the University of Houston, at the Baylor college of Medicine, and the University of Texas in Austin. He is the President of the Alliance for NanoHealth (ANH).

Research Programs. Dr. Ferrari's research is in the field of nanomedicine, and articulates along three main programs: a). Multi-stage particulates for injection into the systemic vasculature, for the individualized, spatially directed delivery of therapeutic agents with maximum beneficial effect and the simultaneous reduction or elimination of adverse side effects; b). Proteomic nanochips for the early detection of disease from blood and other biological fluids; and c). Nanochannelled delivery systems (nDS), or implants for the delivery of therapy in accordance with personalized time-release regimens.

The main medical foci of the research programs in the Ferrari lab are cancer, cardiovascular medicine, and infectious diseases. The three research programs in his laboratory integrate a broadly multidisciplinary set of expertise, including silicon nanotechnology, molecular biology, mathematics, pharmaceutical sciences, physics and engineering. The Ferrari laboratory comprises over 60 professional researchers, students and support personnel. Their work over the last two years has resulted in tens of publications in the most distinguished scientific journals (including the cover of Nature Nanotechnology and two other Nature series publications), over 50 keynote and plenary presentations at most distinguished conferences and venues, 8 patent applications and over 30 institutional invention disclosures that are the first step toward the application for patents by UTHSC-H.

Research Funding – Ferrari Lab. In addition to $ 2.5 MM generously provided through the ETF subchapter F award, Dr. Ferrari's laboratory is funded by grants and contracts from the National Cancer Institute, the Department of Defense (DARPA and

TATRC agencies), NASA, the FDA, the Komen Breast Cancer Foundation, and NanoMedical Systems (NMS). The total non-ETF funding in Dr. Ferrari's lab is currently in excess of $ 10 MM. Several applications from his laboratory are currently being evaluated by funding agencies including the National Cancer Institute, DARPA and the Congressionally Directed Breast Cancer Research Program of the Department of Defense. If funded, these would bring the non-ETF funding total of the Ferrari lab to over $ 20 MM awarded in his first three years in Texas.

Dr. Ferrari was instrumental in recruiting additional faculty to Texas, which were his close collaborators prior to his relocation. They are now in independent positions in Houston and continue to collaborate with his lab. These include Prof. Fredika Robertson of the MDACC and Prof. Vittorio Cristini of UTHSC-H. Their combined awarded funding total to date exceeds $ 10M, and in independent from the Ferrari lab but highly synergistic with it.

Institutional Impact of the ETF Award. In view of the stream of funding and academic successes triggered by the ETF Award to Dr. Ferrari, UTHSC-H has established a novel Division of Nanomedicine in the University of Texas Department of Biomedical Engineering. Under the leadership of Dr. Ferrari, these units will occupy the 6th floor of the new CABIR building on the south campus of UTHSC, with expected occupancy in Q3 2009. The area reserved for biomedical engineering is 33,000 gross square ft. Nanomedicine will there further synergize with programs in biomedical imaging and the computational sciences.

The Alliance for NanoHealth (ANH). Dr. Ferrari was recruited to Houston as President of the Alliance for NanoHealth. The ANH was established through the vision of nanotechnology pioneer Nobel Laureate Rice University Professor Rick Smalley, and Prof. Trip Casscells of UTHSC, who were instrumental in obtaining millions of dollars in federal earmarks to launch the ANH. The ANH is now a consortium of eight institutions, with the mission of bringing nanotechnologies to the clinic. The eight institutions are: UTHSC-H, Texas A&M Health Science Center, MD Anderson, the University of Houston, Rice University, the University of Texas Medical Branch - Galveston, the Methodist Hospital Research Institute, and the Baylor College of Medicine. During Dr. Ferrari's tenure as President, the ANH has secured $ 10 MM in federal funding, with over $ 6 MM expected in FY 2008. The funds obtained to date have been distributed to over 50 investigators in the member institutions, to support collaborative research programs, commercialization efforts, shared research infrastructure, workshops and training opportunities. The total number of investigators affiliated with the ANH is now over 500 from the eight member institutions. These investigators comprise a cadre of excellence of expertise that is second to none in the Nation, and worldwide. These investigators apply for funding independently through their institutions, and not through the ANH. Their entire funding portfolio is not known to the ANH, but is estimated to be easily in the $ 100 M dollar range. The $ 10 M dollars of ANH funding reported above refers only to the funds that were secured centrally by the ANH, and distributed to its members through internal competitions. How much of the overall funding in nanomedicine in the Houston-Galveston area is made possible, enabled or facilitated by

the ANH is impossible to determine. The ANH believes that it does play a fundamental role in the creation of new opportunities and collaborative programs, while of course the merits of the great scientific accomplishments remain solely with the investigators and their laboratories at the various institutions.

Commercialization activities – Ferrari Lab. The nanochannel Delivery Systems (nDS) platform technology from the Ferrari lab has given rise to a Texas-based spinoff company: **NanoMedical Systems (NMS)**. Located in Austin TX, this company was launched in 2008, and has already secured over $ 4 M in private investments from distinguished citizens of the State of Texas. NMS is 'flying-in-formation' with the Ferrari lab, in that the company has licensed the Ferrari patents in the field from UTHSC-H, and funds research in his laboratory. NMS has applied for ETF funding, has cleared with distinction all levels of technical, scientific and commercialization review of the ETF boards, and is awaiting final word from the State Leadership. Dr. Ferrari is the scientific founder of NMS.

A second spin-off company that has licensed Ferrari patents from UTH is **Leonardo Biosystems**. This company was established before Ferrari's recruitment to Texas, and is in the process of physically moving to Houston. Their focus is on innovative, nanotechnology enabled therapeutics against cancer. The company is in the process of licensing patents from several investigators from MD Anderson, and has become de facto a Houston-based company in the course of the last 12 months. Dr. Ferrari is the scientific founder of Leonardo Biosystems.

Leonardo Biosystems was initially funded by private investors, and recently became part of the portfolio of **Arrowhead Research Corporation**, a NASDAQ-listed, publicly traded holding and investment company (NASDAQ:ARWR) comprising 9 companies with focus on various aspects of nanotechnology. In addition to Leonardo Biosystems, Houston-based operations of ARWR include the company Tego (established on Dr. Rick Smalley's fullerene technology and formerly known as C-60), and the company Unidym, which has acquired the entire Smalley portfolio of patents on nanotubes and their applications, through acquisition of Carbon Nanotechnologies Incorporated (CNI). The company is considered the leading private sector establishment in nanotechnology commercialization, and has declared its intentions to open a Houston office in 2008. Dr. Ferrari serves as Director of Scientific Strategy for ARWR.

Commercialization – Alliance for NanoHealth. The more than 500 investigators affiliated with the ANH are involved with a very large number of private sector companies, ranging in size from laboratory spinoffs to large, multinational entities. The ANH does not have an official count of these, but it is estimated to be in the range of 60-100. The ANH has directly financed collaborative work between some of these companies and ANH investigators. ANH fund recipient companies to date include AM Biotechnologies, Fairway Medical Technologies, and Nanobiomagnetics.