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PZFlex® Provides Ultrasound Modeling for Promising Cancer Treatment

University of Leeds scientists are using nano-bubbles and ultrasound waves to transport small doses of chemotherapy drugs through the bloodstream directly to tumor sites.

New York, NY; Mountain View, CA; Leeds, UK – The University of Leeds announced on June 28, 2010, that they had received funding from the UK Engineering and Physical Sciences Research Council to establish proof of concept for a highly innovative method of applying chemotherapy directly to cancerous sites within the body. As developers of PZFlex, the world's leading ultrasound modeling software, **Weidlinger Associates, Inc.** (www.wai.com) provided consulting services for the proposal and was named to the advisory board of the five-year project. The project involves many of the University's medical and scientific faculties, the companies Epigem and Precision Acoustics, and the charity Leeds and West Riding Medical Research.

The Leeds team is proposing that existing chemotherapy drugs be carried inside the tiny gas-filled microbubbles, one millionth of a meter across, that are routinely injected into the bloodstream to obtain clearer ultrasound images (they reflect a stronger signal than the surrounding tissue). A surface chemical or antibody would cause these nanospheres to attach to the targeted region or tumor.

The normally robust bubbles will be subjected to ultrasound frequencies that cause them to vibrate and break apart, which in turn will cause the membranes of the targeted cells to rupture temporarily and fill up with a manageable but effective drug dose. This localized approach should reduce the harm caused to the body by these toxic drugs, as any unburst bubbles are excreted naturally. It will also help technicians reach heretofore inaccessible tumor sites. The bubbles, made from lipids filled with a heavy "fluorocarbon" gas, do not easily dissolve in the bloodstream.

According to lead researcher Professor Stephen Evans, "For the technique to be a viable clinical and commercial option, we not only need to find a reliable way to attach the drugs and antibodies, we also need to be able to manufacture the bubbles in sufficient numbers, of the right size and with consistent properties." One aim of the research is to develop a machine that could be used in clinical practice to manufacture the bubbles. The imaging bubbles produced by current methods are not the correct size for therapeutics.

Weidlinger is working directly with Dr. Steven Freear, a member of the Faculty of Engineering and a licensed PZFlex user since 2007. Freear will focus on how the specially coded ultrasound waves interact with the microbubbles generated by Evans' team. This will allow researchers to model the size and material of the bubbles and the frequency of the

ultrasound wave that will cause them to burst. Existing chemotherapy drugs will be used initially. Testing will be limited to soft tissue areas, as bone interferes with ultrasound imaging, and to tumors that are scheduled for eventual removal, so that scientists can observe the effects of their treatments. Researchers from the Leeds Institute of Molecular Medicine with expertise in colorectal cancer will participate in the verification process.

PZFlex director Paul Reynolds stresses that the science of microbubbles is in its infancy and that “at present, the bubbles are being modeled using classical mathematical techniques. Only equations have been used to predict their reactions.” And while Weidlinger is engaged in very technical issues of modeling the bubbles and their acoustic fields, he points out that “we are very aware that the success of our work has important implications for medical practice. The promise of limiting the dosages and toxic effects of cancer drugs and developing a viable outpatient procedure are very motivating to us.” Weidlinger recently published a paper on bubble modeling in the *Journal of Acoustics* with researchers from the University of Virginia, and is supporting related research at other universities.

Weidlinger Associates[®], Inc., is a 325-person structural engineering firm that designs and rehabilitates buildings, bridges, and infrastructure and provides special services in applied science, forensics, and physical security. The firm, which celebrated its 60th year in 2009, is recognized worldwide for its innovative and practical design solutions and for its long-term commitment to advancing the state of the art in engineering. Headquartered in New York City, the firm has branch offices in the United States and the United Kingdom. For more information, please see www.wai.com.

PZFlex[®] is the registered trademark of Weidlinger’s virtual prototyping software, which is first in world markets for medical therapeutics and sonar. It is the program of choice for all major US and Japanese medical transducer manufacturers, as well as for scientists at prominent academic institutions engaged in studies of diagnostic and therapeutic medical ultrasound. Developed in the 1980s to improve the modeling of ultrasonic probes, PZFlex quickly became the most versatile member of a family of codes (FLEX) used to solve huge wave-propagation problems for the US government. During the past two decades of intensive development, PZFlex has spawned numerous applications and attracted increasing numbers of clients. For PZFlex product support and sales, visit www.pzflex.com or e-mail support@pzflex.com or call (650) 230 0210 (US) or +44 (0)141 303 8303 (Europe).

The University of Leeds is one of the UK's largest medical, health and bioscience research bases, delivering world leading research in medical engineering, cancer, cardiovascular studies, epidemiology, molecular genetics, musculoskeletal medicine, dentistry, psychology, and applied health. For more information, contact Abigail Chard, (tel 0113 258 9880, mob 07960 448532, abigail@campuspr.co.uk) or the University of Leeds Press Office (tel 0113 343 4030, pressoffice@leeds.ac.uk).

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