Multiplexed In Vivo Device to Assess Optimal Breast Cancer Therapy

Grantee: Lee Wilke, MD UW School of Medicine and Public Health, Department of Surgery; Mark Burkard, MD, PhD, UW School of Medicine and Public Health, Department of Medicine; David Beebe, PhD, UW-Madison College of Engineering, Department of Biomedical Engineering

Dates: 3/01/2014 – 2/28/2018

Amount Spent: $499,995

Grant Program: Collaborative Health Sciences Program

The Challenge: Currently it is difficult for oncologists to predict which patients will benefit from available chemotherapy drugs. Cancer treatments remain unfocused and broadly directed, resulting in both under and over treatment. Since learning that cancers are genetically distinct, researchers recognize that cancer treatment could be improved and personalized if they are able to identify effective treatments for these distinct tumors. This is an overwhelming task given that drugs are generally tested on 50 – 200 patients. However, this barrier can be overcome by enabling testing within living cells (in vivo) of multiple cancer-fighting drugs on individual tumors, ultimately allowing for better prediction of drug effectiveness on individual patients.

Project Goal: A team of researchers from engineering, medical oncology and surgery sought to design and test an innovative treatment tool to improve outcomes for women with breast cancer. The team’s goal was to develop a drug delivery device with the necessary functionality to enable localized delivery and assessment of cancer drug response in vivo. By delivering and simultaneously testing multiple drugs within a tumor, the tool has the potential to remove current barriers to drug testing and pave the way for personalized cancer treatment. Upon successful completion of this study, the team will test the device in humans with the ultimate goal of bringing it to the clinic.

Results: The project team successfully developed the first ever implantable device that both enables sustained local drug delivery and assessment of tumor response to determine the most effective anticancer drug combination for breast cancer patients. The small, implantable device allows efficient, minimally invasive delivery of drugs within a tumor, sparing future patients from the unnecessary drug toxicity of full and unspecified chemotherapy treatments. Specific drugs or drug combinations can be delivered to different areas of the tumor; then surgical removal of the tumor with the devices in place enables assessment of drug effectiveness on affected cells. Researchers successfully demonstrated the technical capabilities of the device in mouse tumor models and are positioned to seek extramural funding to initiate human trials.

The technology has successfully been awarded a US patent and the team is applying for extramural funding to support studies of the device in human patients. The project also resulted in multiple presentations and publications including at the Annual Midwest Tumor Microenvironment Meeting 2017; Wisconsin Alumni Research Foundation (WARF) solicitation Implantable Cancer Drug Delivery Device Signals the Future of Personalized Medicine; Localized In Vivo Drug Response Assessment Via a Needle-Implantable Microdevice (to be submitted in 2018), Health Canal Web Journal (2014) article as well as UW Carbone Cancer Center materials and publications.