NCI: Leading Small Business Innovation and Commercialization in the Fight against Cancer

The National Cancer Institute (NCI) is the Federal Government's principal agency for cancer research. NCI's goal is to reduce the burden of suffering and death due to cancer. The NCI Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR) Programs are NCI's engine of innovation for developing and commercializing novel technologies and products to prevent, diagnose, and treat cancer.

One Company's Story: AntiCancer

AntiCancer, the San Diego-based biotechnology company, has a long history with the National Cancer Institute's Small Business Innovation Research (SBIR) Program. "The company really got started with its first SBIR grant in 1986," said Dr. Robert Hoffman, chief executive officer of AntiCancer. AntiCancer has been working with the NCI SBIR Program ever since. Over the past 23 years, AntiCancer competitively applied for SBIR funding and was awarded grants and contracts to help advance cancer research technologies, including the development and commercialization of three research tools: MetaMouse®, AngioMouse®, and OncoBrite®.

Dr. Hoffman credits much of AntiCancer's success to sound science, discipline, an understanding of cancer research needs and markets, and the NCI SBIR Program. "We are very grateful for the support of NCI SBIR," said Dr. Hoffman. "SBIR enables small businesses to put science first, and it helps us maintain intellectual property rights and ownership of our company."

The NCI SBIR Program has helped AntiCancer grow its business while making important advances in cancer research. AntiCancer began with just five part-time employees. Since that time, AntiCancer has grown tremendously in technology, product development and commercialization, and staff size. AntiCancer now has 80 patents and 38 employees.

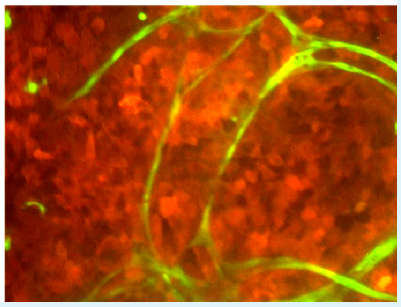

Figure 1.
AngioMouse® with GFP-expressing blood vessels visualized in RFP-expressing mouse melanoma

Source: Yang M, Li L, Jiang P, Moossa AR, Penman S, Hoffman RM. Dual-color fluorescence imaging distinguishes tumor cells from induced host angiogenic vessels and stromal cells. Proc. Natl. Acad. Sci. USA 100, 14259-14262, 2003. Copyright 2003 National Academy of Sciences, U.S.A.

Today, AntiCancer is a leader in small-animal imaging technology and mouse models. With the support of the NCI SBIR Program, AntiCancer was able to research, develop, and commercialize leading mouse models for cancer research, including MetaMouse ® and AngioMouse® (Figures 2 and 3). These models are made imageable with AntiCancer's OncoBrite® technology using fluorescent proteins. AntiCancer successfully applied for SBIR funding and was awarded Phase I and Phase II SBIR grants for each of these technologies. The mouse models are now used in contract research with pharmaceutical and biotechnology companies to support novel cancer drug discovery and evaluation.

About the NCI-Supported Technologies

MetaMouse® is a metastatic patient-like mouse model designed to mimic the progression of cancer in humans. To create the tiny cancer patient models, AntiCancer utilizes a technique of surgical orthotopic implantation (SOI), which involves the transplantation of fragments of human cancer into the corresponding organs of mice. For example, pieces of a lung cancer tumor are inserted into the lungs of a mouse, which then metastasize.

Prior to the development of MetaMouse®, conventional rodent tumor models involved injecting suspensions of single cells from tumor cell lines beneath the skin of nude mice or on corresponding organs. The MetaMouse® technology advanced mouse models through the creation of an *in vivo* environment that more closely reflects cancer in clinical situations. The SOI method used in

MetaMouse® also improved the ability of cancer to metastasize in mouse models and confirmed that the site of tumor implantation makes a difference in tumor progression.

Tumors in MetaMouse® metastasize and respond to cancer therapeutics, much like they do in humans. The tumors also cause cancer symptoms that mirror symptoms experienced by humans. AntiCancer further enhanced the MetaMouse® technology through its development and commercialization of AngioMouse®, a fluorescent mouse model that facilitates the ability to monitor angiogenesis in cancer, the growth of new blood vessels that supply blood and oxygen to tumors.

OncoBrite® is a fluorescent protein-based *in vivo* small animal imaging technology that enhances the visualization of cancer in the AntiCancer mouse models. To better image progression and metastases of cancer tumors and angiogensis *in vivo* in MetaMouse® and AngioMouse®, AntiCancer has adapted and patented a technique using green fluorescent protein (GFP) and red fluorescent protein (RFP) in mice. These multicolored proteins are isolated from the jellyfish *Aequorea victoria* and corals. AntiCancer genetically engineers tumors to selectively express high levels of the fluorescent proteins and surgically implants the tumors into mouse models. GFP or RFP expression in primary tumors and in their metastases can be detected by the intense green or red fluorescence, which can then be imaged. The use of OncoBrite® in AngioMouse® enables scientists to easily visualize angiogenesis in cancer because the GFP-transfected tumor cells fluoresce, but the host's blood vessels do not. Alternatively, two color models can be engineered in which tumor cells express RFP and blood vessels express GFP.

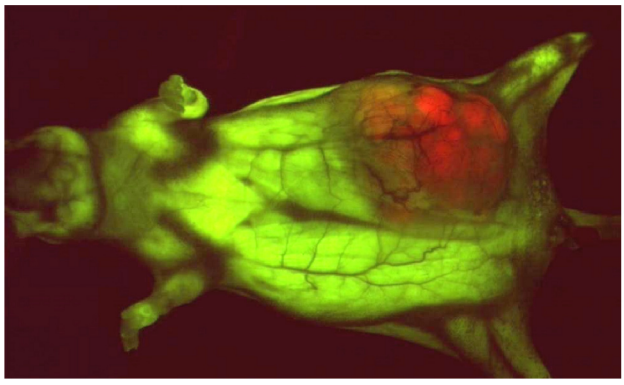

Figure 2.
AngioMouse® with orthotopically growing HCT-116-RFP human colon cancer in a GFP nude mouse.

Source: Yang M, Li L, Jiang P, Moossa AR, Penman S, Hoffman RM. Dual-color fluorescence imaging distinguishes tumor cells from induced host angiogenic vessels and stromal cells. Proc. Natl. Acad. Sci. USA 100, 14259-14262, 2003. Copyright 2003 National Acadamy of Sciences, U.S.A.

Advancing Cancer Research

The ability to evaluate experimental cancer therapeutics in a human-like environment is critical to drug discovery. Together, MetaMouse®, AngioMouse®, and OncoBrite® help advance cancer research. These technologies provide cancer researchers with the tools to visualize primary tumor growth, metastasis, angiogenesis, and to monitor tumor response to new therapeutics in a non-invasive manner *in vivo*.

More about the NCI SBIR & STTR Programs

For more information about how the NCI SBIR & STTR Programs can help your small business advance cancer research, treatment, and prevention, or to find out about upcoming funding opportunities, visit http://sbir.cancer.gov. To sign up to receive email updates from the NCI SBIR & STTR programs, visit http://sbir.cancer.gov/email_signup.asp.

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