

Imaging Facility to be a first for animal & veterinary sciences



CVM researcher Mark Lawrence, left, and MAFES animal and dairy scientist Scott Willard use biophotonics to study enteric septicemia in catfish.

By Charmain Tan Courcelle

The pooled resources of the Department of Animal and Dairy Sciences and the College of Veterinary Medicine may help establish Mississippi State University as a leader in imaging technologies for the agricultural and veterinary sciences.

MSU scientists already apply satellite-based remote sensing imagery to agriculture. However, Scott Willard and Peter Ryan, MAFES animal scientists, want a much closer, earthbound view of the challenges facing the animal food production industry.

“We’d like to take microscopy and other imaging systems and apply them to areas in large animal agriculture — for example, animal health, food safety and pathogenesis (of microbes found in food animals),” Willard said.

Together with CVM researchers Hart Bailey and Mark Lawrence, Willard and Ryan are working to establish a core laboratory facility equipped with current imaging technologies that will help them do just that.

Two of these technologies — biophotonics and fluorescence microscopy — take advantage of molecular reporters that allow researchers to easily examine functions and structures within living cells, tissues or organs. Biophotonics captures the glow from cells that have received the firefly gene luciferase to reveal chemical reactions within biological systems. A gene from the jellyfish *Aequorea victoria* imparts vivid colors of green, yellow or blue-green to “transformed” cells that can be detected with a fluorescence microscope.

Infrared thermal imaging and ultrasound imaging, the two other techniques of interest to the team, are used commonly as noninvasive examination and diagnostic tools in medical and veterinary settings.

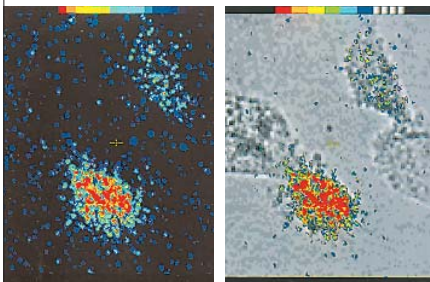
“The real beauty of these systems is that you can do dynamic, real-time analyses of living organisms,” Willard said. “These techniques can be used to ask and answer questions related to how cells interact with each other or how they respond to external signals like environmental agents, toxins or disease organisms.”

The team agreed that this type of understanding would help reveal more about animal physiology and provide clues to improving animal handling practices and to preventing animal disease.

The foundation for an imaging facility has been laid with existing ultrasound machines and with new biophotonics, fluorescence microscopy and infrared thermal imaging equipment. Much of this equipment was obtained as part of a current neuroscience collaboration among Willard, Ryan and CVM researchers Jan Chambers and Russell Carr, which is sponsored by the National Science Foundation. Willard, Ryan, Bailey and Lawrence plan to extend the application of this technology further to tackle questions in food animals.

To test this possibility, the team will initially use catfish as a model organism. The group hopes that by the end of this fall, they will have a clearer idea of the range of these imaging technologies. In the meantime, efforts continue to improve the facility’s work space and to expand its imaging capabilities.

“We think setting up a core imaging facility on this campus will give us a jump in providing answers to animal production questions,” Ryan said. “Imaging resources like this are usually found in medical schools, but we hope to change this by establishing one of the first centers in the agricultural and veterinary sciences.”



Living porcine (swine) ovary cells respond to estrogen treatment by turning estrogen-sensitive genes on. Left: This panel shows gene expression in the ovary cells as detected by biophotonics. The intensity of each colorized dot indicates the level of gene expression, with red indicating an increase in activity. Right: This panel shows an overlay of the biophotonic emissions on the ovary cells. This technique is used to determine the level of estrogen-sensitive gene expression in individual cells.

Images provided by Scott Willard