VMTH Builds Open Heart Surgery Program

“A surgical team of at least nine, including faculty, RVTs and staff technicians, plus 11 intensive care and essential ancillary staff carries out cardiopulmonary bypass surgery at the William R. Pritchard Veterinary Medical Teaching Hospital.

“Surgery is very successful, essentially curative, in a large proportion of canine patients,” says veterinary cardiologist Dr. Leigh Griffiths, who leads the open-heart surgery program at the William R. Pritchard Veterinary Medical Teaching Hospital.

“About 20 percent of our cases are young dogs with congenital heart disease,” says Dr. Griffiths.

“The majority of our cases have mitral valve disease, which is the most common acquired heart disease in dogs. The surgical success rate is 70 percent. Currently the only other treatment is medical therapy, which gives patients a prognosis of about six to 18 months. With a successful surgery the majority of patients are essentially cured. We have patients without any clinical signs of heart disease after six years.”

“UC Davis is now the only place in the United States that has regularly scheduled open heart surgery for animals,” he says. “A team of about 20 people spent more than a year training together to do open-heart surgeries—with everyone learning about not just their bit, but every stage of the procedures and equipment.”

The program started off in October 2009 with one case per month. “The goal, as we build the program,” says Dr. Griffiths, “is to do at least 100 to 150 cases per year.” In order to develop and maintain a high success rate, the technically challenging
procedures must be carried out with enough frequency to keep the surgical team in top form.

“We can basically do anything they can do in humans,” says Dr. Griffiths. “The only exceptions are coronary heart disease, because dogs don’t get it, and aortic valve replacement, a procedure that is far more difficult to do in dogs than in humans.”

Open-Heart Procedures
There are two types of “open-heart” surgical techniques. Only a handful of schools in the U.S. could even consider doing either highly specialized technique, says Dr. Griffiths.

“Cardiopulmonary bypass,” only being done for dogs at UC Davis, involves the heart-lung machine, and allows surgeons to open the heart in a controlled way for one to two hours.

“Inflow occlusion,” which is much less expensive, allows only a minute or two for the entire procedure, says Dr. Griffiths. “We stop all blood flow, empty the heart of blood, open the heart and do the procedure. Inflow occlusion is most commonly used for pulmonic stenosis, a congenital heart disease in dogs; surgeries such as tumor removal; and cor triatriatum, a disease in cats. Fortunately, cats get fewer heart diseases that can be treated with surgery, as physiologically they are more difficult.”

Visit the VMTH Cardiology Services Web site for practitioners and clients for information about open-heart and other procedures, costs and expected outcomes (http://www.vetmed.ucdavis.edu/vmth/small_animal/cardiology/).

Research: Tissue Engineering a Better Heart Valve
“Mitral valve disease in dogs is the most common disease we deal with,” says Dr. Griffiths, “but by the time the disease is recognizable in veterinary medicine, the valve is almost beyond repair.”

One arm of Dr. Griffiths’ research program is to produce a better heart valve for dogs using tissue engineering, applicable to both dogs and humans.

Tissue valves made from either bovine pericardium or porcine aorta are already being used for heart valve replacement in humans. “We know how to make those tissues into a valve that works and functions well,” says Dr. Griffiths. “Currently, the valve is glutaraldehyde-fixed, which cross-links all the proteins, so that, in theory, the immune system won’t attack it. In humans, we used to think the reason the valve degenerated after about 10 years was just mechanical. There is now a lot of evidence that it’s still the immune system, but it takes 10 years to destroy the valve, because the glutaraldehyde fixation slows down the process.

“The goal, if you’re trying to make a tissue-engineered valve for either human or canine application, is to remove from the tissue everything to which the immune system would react. In humans, you then take stem cells from the patient and grow them into that material for long-term growth and repair of the tissue. We don’t need to grow stem cells back into the tissue for dogs, because they have a shorter life expectancy than people.

“Our research is involved in (1) looking at what the immune system reacts to and (2) how we can remove those things from the tissue—at which point we would have a tissue-based material appropriate for making valves for dogs.”

Working to make a tissue-engineered heart valve for dogs, Maelene Wong, PhD student in the Biomedical Engineering Graduate Group, and Dr. Leigh Griffiths, assistant professor of cardiology in Veterinary Medicine and Epidemiology, assess the immune response to one of the antigens present in bovine pericardium.