All in the Family

The discovery of ‘microchimerism’ in dogs could lead to better understanding of disease in humans.

Story by Erik Potter

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The telltale signs of children are evident in the back seat of any car that schlepps kids: Cheerios crumbs lodged in the seats, fruit chew wrappers strewn on the floor, a sippy cup poking timidly through the detritus. Kids leave messes behind.

It’s a habit that can start even before birth, when baby John or baby Jane leave some of their cells behind in mom. Those cells can survive for years, and, in “take a penny, leave a penny” style, subsequent children can pick them up and, in turn, leave some of their own cells behind. It’s a condition called microchimerism — from the Greek “chimera,” a mythical hybrid creature that's part lion, goat and snake. In mothers it's associated with a lower risk of developing some diseases, such as breast cancer, and a higher risk of developing others such as thyroid disease.

Associate Professor Jeffrey Bryan is trying to improve immune system transplantation through his research on microchimerism in dogs. Photo by Karen Clifford.

"When I first heard about this, it blew my mind," says Jeffrey Bryan, associate professor of oncology in the College of Veterinary Medicine.

However, research in humans on the long-term effects of these foreign cells is difficult because of the long gap between childbirth and the onset of cancer and other diseases. Which is why Bryan was so excited when he took blood samples from female dogs who'd had male puppies and, through DNA testing, found male Y chromosomes circulating in a third of them, proving that dogs can also be microchimeric.

Dogs share the same environment as humans and develop many of the same diseases, so research into canine disease often has important implications for human health. And dogs, with their shorter life spans, make easier study subjects.

The field of microchimerism is still wide open. Among the many unknowns are: how long the chimeric cells can live in mom; if the cell populations rise and fall, and if so, why; if cells from subsequent children crowd out the cells of earlier children or if they coexist.

The ultimate question, of course, is what the relationship is between microchimerism and the development of disease.

Using a canine DNA database, Bryan is looking for a relationship between microchimerism and lymphoma incidence in golden retrievers. Another line of Bryan's research is on microchimerism as a predictor for immune system transplant success.

Cancerous tumors can only grow large enough to be destructive if they first fool the host immune system into ignoring them. It's the reason why getting someone else's immune system — accomplished by transplanting bone marrow — can help fight an existing cancer: The outside immune system hasn't been fooled and recognizes the cancer for what it is.

However, immune system transplants come with risks of complication, and suitable donors can be hard to find. In cases of leukemia and lymphoma, 70 percent of patients needing a bone marrow transplant find a donor within their family, but 30 percent have to hope for a match from a stranger, which often doesn't happen. For a patient in the unlucky 30 percent, if Bryan can show that he or she is microchimeric and has been living with the cells of a child or older sibling for years without incident, it would indicate that that relative is a suitable bone marrow donor.

Such transplants, if successful in dogs, would be "proof of principle" that the practice can work in people.

"If we could figure out how to do it more easily, with less toxicity, then that would be a big step forward on the human side, too," Bryan says.

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