BAKER INSTITUTE *for* ANIMAL HEALTH

Dedicated to the study of veterinary infectious diseases, immunology, genetics, and reproduction.

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Scientific Breakthrough – M...

One of two cocker spaniel-beagle mix puppies born via *in vitro* fertilization in the Travis lab.


Dr. Travis with his dog Buck. Born in 2005, Buck is the result of the Travis lab's first successful embryo transfer from one dog to another.


Klondike, born in 2013, was the first dog in the Western Hemisphere born from a frozen embryo.

News: First Successful *In Vitro* Fertilization In Dogs

December 9, 2015

The first puppies born by *in vitro* fertilization (IVF) were delivered on July 10, 2015 at the Baker Institute for Animal Health. This advancement could help preserve endangered canid species and open new means for discovery in human and canine genetic diseases. The births are the first time this assisted reproduction technique, in which ova and sperm are brought together to create embryos, has been successfully accomplished in a dog. Taking this several steps further, these embryos were then frozen, stored, and transferred into a female, who gave birth to seven healthy puppies.

IVF Puppies: Facts and FAQs

"Right now about five species of wild dogs and wolves are threatened with extinction, and managing fragmented populations of these animals is going to require more hands-on approaches," says Dr. Alex Travis, Baker Institute scientist and Faculty Director for the Environment, Atkinson Center for a Sustainable Future . "We're going to need technologies such as IVF to move genes around to maintain their genetic diversity and to improve the health of these species."

Watch Dr. Travis' interview and see the puppies in action!

Because of the tremendous need, scientists have struggled for more than 40 years to develop fertilization techniques in dogs, but the differences between canine reproduction and that of other mammals slowed progress. Female dogs ovulate only once or twice per year, and their eggs are released from the ovary in a very immature state compared with other mammals. These immature cells must spend two or three extra days in the oviduct to complete their maturation and become able to be fertilized. And unlike human or mouse oocytes, which are light in color and easy to examine under a microscope, dog oocytes are almost black in color, making it difficult both to examine them and freeze them. Dog sperm present their own difficulties. To become capable of fertilization, they undergo a maturation process within the female reproductive tract, a process called capacitation. To prepare sperm for fertilization, Dr. Travis and his team duplicated the environment of the female reproductive tract with a tailor-made liquid medium supplemented with magnesium, an element they tested and found to be crucial to the capacitation process.

Read the research article

Over a set of experiments, the team pinpointed the correct time after ovulation to collect mature oocytes from female beagles, then combined them with either beagle or cocker spaniel sperm that had undergone the capacitation process *in vitro*. Once the resulting embryos had grown to the four cell stage, they were stored frozen, then transferred to a female hound when she was at the right stage of her cycle. Out of 19 embryos transferred, seven embryos implanted and the surrogate mother gave birth to seven healthy puppies

(five beagles and two cocker spaniel-beagle mixes). Genetic testing by an outside laboratory indicated that the dog who carried the puppies to term was not the genetic mother, confirming the procedure had been completed successfully.

IVF in dogs promises to not only help restore populations of endangered wolves and foxes, it also opens doors to studying genetic disorders in dogs and humans alike, says Travis.

"There are many genetic diseases of dogs that also afflict humans," he says, including certain forms of blindness, cancers, and others. "If we can identify what genes are responsible for a given condition, then coupled with new gene editing approaches, this technology gives us a way to actually fix that gene, and prevent illness rather than wait for the individual to get sick and then treat it."

The procedure is the culmination of many years of work in the Travis laboratory, as every step of harvesting oocytes and sperm, maturation, fertilization, storage, and transfer required testing and optimization. Travis' own dog, Buck, was born as a result of the lab's first successful embryo transfer from one dog to another in 2005. Klondike, a lab mix born in 2013, was the first dog in the Western Hemisphere born from a frozen embryo. Travis' former graduate student, Dr. Jennifer Nagashima, carried out much of the IVF work as the first participant in a joint program between Cornell University and the Smithsonian Conservation Biology Institute that is designed to foster collaboration on wildlife conservation projects.