

## From penguin hearts to addax embryos: 'Frozen zoo' helps preserve, save lives

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There's another zoo in St. Louis, and it sits in the shadow of Highway 40, behind wooden gates and laboratory doors, inside 13 freezers and 10 tanks filled with liquid nitrogen.

There are 1,200 semen samples from banteng bulls, which are endangered. In all, there are 18,000 samples of blood and serum that can be used to study diseases and help medicate animals, including an itchy Andean bear at the St. Louis Zoo named Maria, who recently got the treatment she needs to help with her allergies.

There are also samples and organs from animals who have died over the past 19 or so years, including Robert B., an endangered Sumatran orangutan who died in July from lung issues but whose organs have been frozen and preserved for study.

The St. Louis Zoo's frozen zoo is like a bank, an important depository of tools that researchers can use to help animals now and in the future. It's housed in the Endangered Species Research Center and Veterinary Hospital, Home of the AZA Reproductive Center, behind River's Edge and within sight of the cheetah exhibit. It's only open to the public for special tours.

"People have been blown away by what we've been able to achieve," said David Powell, who joined the zoo as its director of research in August. That's why they freeze so many things for a rainy day, knowing technology can only improve. "The science can proceed faster when you

have the materials."

The work they're doing there has implications worldwide, including helping some species from being wiped off the planet.

For example, in the late 1980s, there were only seven known Mexican gray wolves left on the planet. The St. Louis Zoo worked with the Infertility Center of St. Louis to develop a way to freeze sperm and use it to inseminate wolves, explains the zoo's laboratory manager, Karen Bauman.

The St. Louis Zoo has the largest sperm bank of Mexican gray wolves in the world, and - largely due to its work - there are now 250 of the animals in captivity and about 100 in the wild. Now that the zoo has done so much work on banking and perfecting their preservation recipe ("It makes beautiful sperm," Bauman said) they can now focus on genetic management.

They haven't figured out how to produce embryos in wolves, but they have frozen eggs for when that day comes. When it does, the gene pool will broaden. "They're gorgeous animals in many respects," Bauman said. "They are just magnificent."

About 15 years ago the zoo was asked whether it could transfer addax embryos and ship them overseas, which could be easier than shipping an entire 200- to 300-pound animal. They figured out how to produce addax embryos but got stuck trying to figure out controlling a female addax's ovulation cycle. So the embryos will sit in the tank until they figure that out. Meanwhile, conditions for addax in the wild continue to decline, Powell said.

Every [sample](#) housed in the frozen zoo is listed in a database, and the zoo often shares samples with other zoos doing their own research and

reproductive work.

This fall, the St. Louis Zoo shipped frozen semen from an endangered Banteng bull, Bubba, to the zoo in Columbus, Ohio, to use to inseminate four cows. Bubba has been dead for several years. "He's been in our tank, waiting his turn," Bauman said. "And hopefully, four cows are pregnant."

Some samples are collected during routine exams and others collected systematically. When Bauman isn't in the field with the wolves, she still acts as a keeper at the frozen zoo, answering middle-of-the-night calls from the alarm company if the electricity goes out. She still has to drive in to make sure everything's OK.

The frozen zoo also helps keep live animals healthy. They'll run hormone panels and compare that to stress levels from five years ago to help animals adjust, or save blood to see if a drug works for a new species, said veterinarian Luis Padilla, head of animal health at the zoo.

"When an animal gets sick, we could pull back samples from the frozen zoo and ask, is this something happening for a while or an emerging disease?"

They will also pull serum samples to learn about the nutritional needs of endangered animals and are currently looking to see whether painted dogs need more fat in their diets, and whether there are differences between zoo gorillas with and without cardiac disease.

Mary Duncan is the zoo's pathologist and performs biopsies on living [animals](#) and necropsies on ones that have died. Just recently, she removed a large mass from a gecko and froze a portion of it in case they need to test it later for a viral infection. Depending on the animal, they'll freeze the tumor. Jaguars are known for mammary tumors, so they'll

freeze a portion of those to see whether they are associated with a gene mutation.

During what was probably the St. Louis area's strangest freezer cleanout recently, she had to prioritize what to keep and what to throw out, and to make the decision that yes, they probably didn't need quite so many guinea pig tumors. (How many did she clean out? "A lot," she confessed.)

She's interested in doing research on penguins, which tend to die from heart issues, so she has frozen samples of about 20 or so penguin hearts from the past two decades.

"For me, having the frozen samples opens up the possibility of looking at so many things retrospectively," she said. "It gives you so much potential."

She points to the example of a frozen human body in Alaska dug up from the 1918 flu epidemic and tested for research, possibly to help prepare for and maybe prevent another human pandemic.

Powell, the zoo's director of research, said nobody could have predicted the advances that have taken place in research for the last 20 years. The frozen samples will help with the next breakthroughs.

"We hit an inflection point," he said. "We don't know when that will come, but the frozen zoo has to be ready."

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