BREEDING

REPRODUCTIVE CHALLENGES FOR WHITE RHINOS IN ZOOS

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The adage "you are what you eat" can be problematic for some southern white rhinos in zoos. While female rhinos brought in from the wild to join zoo-based programs reproduce well, females born in zoo settings tend not to bear offspring as often. These wide-lipped grazers seem to be sensitive to compounds called phytoestrogens found in soy and alfalfa, which make up the lion's share of the animals' diet in zoos. "During their 16-month gestation, female calves could be exposed to the compounds through Mom's diet, resulting in permanent fertility issues later in life," explained Chris Tubbs, Ph.D., scientist in the Reproductive Physiology Division of the San Diego Zoo Institute for Conservation Research. "These plant-based (phyto) estrogens activate receptors that regulate estrogen function."

As females of many species can attest, normal estrogen function is precisely controlled, and when things get out of kilter, it can lead to turmoil. For female southern white rhinos, absorbing the "imposter" estrogens tampers with their reproductive success; and the more they consume, it seems, the less fertile their daughters will be later in life. Only about one-third of southern white rhinos born in zoo settings successfully reproduce in their lifetime, making a sustainable population a challenge. Interestingly, other species of rhinos in zoos do not have the same problem.

Test Tube Riddles

When our phytoestrogen project began in 2007, it was the first "receptor-based study to address the zoo rhino reproductive issue" taking a laboratory approach, explained Chris. (Since then, similar work by Chris and his team involves studying how chemicals in the environment affect the biology of free-flying California condors.) But the project has taken on a real urgency due to the 100-fold increase in rhino poaching in recent years. "More than ever, we need self-sustaining populations of white rhinos established outside of Africa," he said. Last year alone, about 5 percent of the entire white rhino population was slaughtered.

For scientists in conservation endocrinology, finding solutions to this complex problem entails test tubes, diet samples, food extracts, and a collaborative effort spanning multiple levels of biology. "If you just focus on one aspect of the research, you lose sight of the others," Chris said. This project is a collaboration between keepers, animal care managers, veterinarians, and scientists; laboratory work is crucial to saving this species. In addition to combing through white rhino studbook records, zoos around the country were asked to send samples of their rhino diets for testing phytoestrogen content. This may seem straightforward, but since many rhinos are housed with other species (like at the Safari Park), those animals may get a different diet—if a 5,000-pound rhino

AND EATING

Facing page: Dr. Chris Tubbs and the Reproductive Physiology team are working to solve this rhino reproductive mystery. Above: Rhino calves are precious...and adorable! Below: Pellets are part of the diet for rhinos in zoos.

lumbers over for a bite, few animals are going to argue. Hence, rhinos can eat just about anything they get their lips on.

Yet another wild card is the climate of the place they live. Most rhinos in zoos receive a significant amount of commercial pellets as part of their diet. The pellets are readily available year round, affordable, and packed with vitamins and minerals…and phytoestrogens. However, it has been observed that rhino mothers that eat more naturally occurring fresh grasses during their pregnancy have a higher rate of successful reproduction. The director of Nutritional Services at the San Diego Zoo, Michael Schlegel, Ph.D., is collaborating with groups to develop a grass-based pellet for rhinos, which is being tested in the lab by Chris and his colleagues. Finding a pellet with lower phytoestrogen content could help get female white rhinos back on track.

Further diet studies will also be tackled, addressing the microorganisms in the rhino's gut breaking down all that plant material. How are phytoestrogens digested in the gut? Are they converted into a form more or less potent—and potentially harmful to a female's reproductive future?

The reproductive life of southern white rhinos in zoos is still shrouded in mystery, but the challenge is being looked at with fresh eyes. Chris and his team are grateful "there is support in the organization to develop and employ new approaches to conservation science," he said. "We can affect change and benefit the animals through cooperation and collaboration with different groups." Each new southern white rhino calf frolicking next to its mother at a zoo will be just as appreciative. ▪

Examining the Genome

San Diego Zoo Global is pleased to receive a generous grant from the Seaver Institute, which will enable our Genetics Division to begin sequencing white rhinoceros genomes. This critical scientific component will provide much-needed data clarifying the differences between northern and southern white rhinos; identify the amount of surviving genetic variation in these two forms of rhino; and provide a crucial tool to achieve advance reproductive technologies to save rhino species.