

OUT OF OFFICE

Urologists and Innovation for Chimpanzee Sexual Health

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Since the 2015 National Institutes of Health ban on chimpanzee experimental testing, sanctuaries across the United States have begun transporting hundreds of chimpanzees from labs to their new protected habitats.^{1,2} One such facility is Project Chimps located in Blue Ridge, Georgia. Nearly 80 chimpanzees call this 236-acre forested facility home. The mission of Project Chimps is to provide life-long exemplary care to chimpanzees retired from research.³

Project Chimps Is One of Only 5 Authorized Sanctuaries in the Country Focusing on Humane Care of a Large Population of Retired Medical Research Chimpanzees

While some sanctuaries have chimps from different backgrounds, all the apes at Project Chimps come from just one lab, the New Iberia Research Center in Louisiana. They are privately owned, which means



Figure 1. Counsel of Medical Professionals visiting Project Chimps.

the chimps do not receive any support from our taxes or the government the way that National Institutes of Health chimp retirees do.

While touring the grounds of Project Chimps, my wife, Susan Kirsch, MD and I met the lead veterinarian. We were informed of the myriad of medical and emotional needs these animals experience, and we became fascinated with the intelligence and personality that these primates possess. Chimpanzee anatomy is so like humans that there is significant crossover in the treatment plans, pharmaceuticals and even the medical equipment needed to provide them exemplary care. As the medical devices used are not meant for great apes, creativity with adaptation and specialized training is implemented for certain use cases. While a veterinarian oversees their medical care plans, it is important to consult with human specialists to be able to provide the best care possible. In other words, a liaison between veterinary and human care is essential. Touched by the experience at the facility, my wife and I decided to become involved and initiated discussions with Ali Crumpacker, Executive Director at Project Chimps since 2017. We recruited and now oversee a team of physi-



Figure 2. The chimpanzees in their enclosures have free range to interact with each other (and occasionally will engage with visitors).

cians and surgeons to improve the care of these magnificent animals (Figures 1–5). I became the chief medical liaison between the veterinarian and physicians. In addition to urology, the surgical team represents orthopedics, gynecology, general surgery, plastic surgery and more. Dr. Susan Kirsch, a child and adolescent psychiatrist, leads the psychiatric consultation and works closely with the animal behaviorist. Additionally, a medical care team specializing in hematology, nephrology and cardiology rounds



Figure 3. Care is taken to separate humans from the chimpanzees to allow for the most natural environment possible.

out the current group of physician volunteers. Our entire Georgia Urology practice was moved enough to sponsor the appropriately named “Banana Grove” at Project Chimps. When doing rounds on the chimps for the first time, I was greeted with a lightning quick hand splash of urine and stool—a traditional greeting to a newcomer!

A critical medical issue that came to light on a physician care team site visit to Project Chimps is birth control. Unwanted births can hinder conservation efforts due to the chimps’ high maintenance costs.

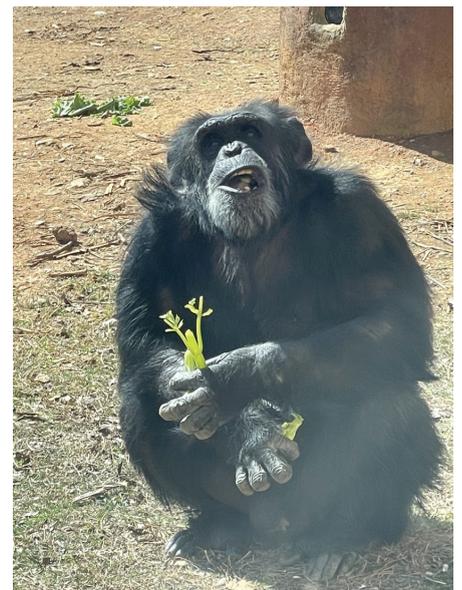


Figure 4. Care is taken to ensure the chimpanzees are fed a well-balanced diet with an emphasis in the Strategic Plan to provide food from their own farmland on campus.



Figure 5. As part of Project Harvest, the mission to provide home-grown food for the chimpanzees, Georgia Urology sponsored the planting of a banana grove (one of many needed tree donations).

Females are placed on birth control and the males undergo vasectomies.⁴ Where a human vasectomy is a 1-time procedure, chimps have a unique regenerative ability where their vas deferens can re-cannulate within a few years—even when performed by a urologist.⁴ Thus, every 4 years, veterinarians place the chimps under anesthesia and directly observe if the vas deferens remains disjointed.⁴ Because of chimpanzees' inherent vulnerability to heart conditions, this anesthesia places them at high risk of heart complications and death.⁵ The alternative to an examination under anesthesia is semen collection.

The Challenge: How Do You Get a Great Ape to Reliably Produce the Necessary Semen Sample?

While some chimps have been successfully trained, compliance remains a large concern, and a more effective device appealing to the mating preferences of a chimpanzee is vitally needed. In learning of these challenges, my colleague, Dr. Emily Blum, the Medical Director of the Global Center for Medical Innovation at Georgia Institute of Technology, saw an opportunity to capitalize on the engaging ecosystem for medical technology development in Atlanta.

Capstone biomedical engineering projects serve to identify unmet medical needs and develop

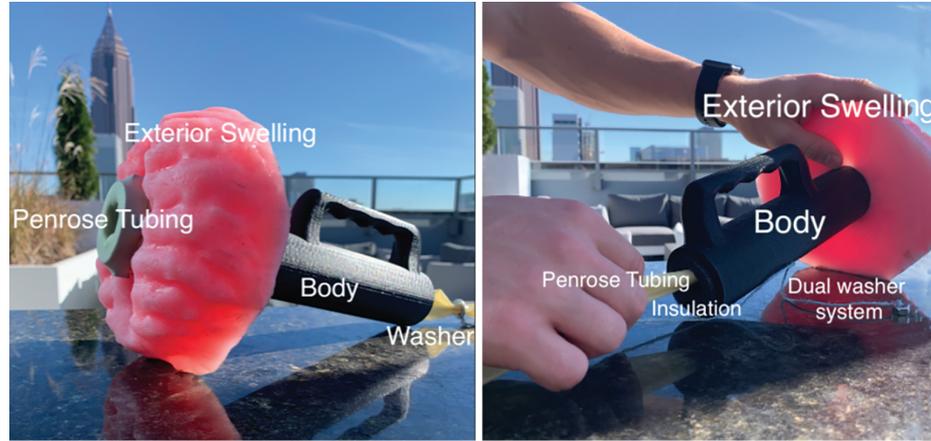


Figure 6. Photograph of semen collection device with general features labeled.

Chimpanzee	Reactions
Hercules (left) and Jacob (right) 	Hercules and Jacob begin to fight over who can inspect and use the device.
Marlin 	Marlin inspects the device by inserting his finger inside. This behavior mimics the behavior of chimpanzees living outside of captivity.
Multiple Chimpanzees 	Chimpanzees gather at the fence to observe the device. Their reactions show that they are intrigued by the physical appearance of the device since it mimics the swelling seen in ovulating female chimpanzees.

Figure 7. Chimpanzee initial reactions to the new semen collection device.

prototype devices to address the challenges found during the discovery process. These are typical projects that engineering students across the country undertake. The biomedical engineering teams at Georgia Tech work very closely with industry specialists and physicians to design and develop projects addressing specific needs. The team of 5 Georgia Tech students met with animal behaviorists, veterinarians, urologists and the chimpanzees to design and develop a semen collection device that would be well received and easy to train the chimpanzees to use. Certain key hurdles were identified in their discovery process. Central to the design was to mimic the female chimpanzee's appearance during an estrous cycle. Female chimpan-

zees have an external vaginal swelling that grows in size and becomes pinker during peak ovulation. Prior to mating, the males inspect the appendage, which is soft both internally and externally and has folds that add texture to the surface.

No Design to Date Has Attempted to Employ These Visual and Tactile Features in Devices for Great Ape Reproductive Health Monitoring

The team focused on designing a device that mimics the appearance and texture of an ovulating female chimpanzee, which caters

to the chimpanzees' natural mating preferences. By examining photos of ovulating chimpanzee vaginal swellings, they found that the color lies within a certain range and learned that the swelling has a specific surface area.⁶ Using silicone rubber and pigment, these key features were successfully emulated. Injection molded foam lining within the device lumen closes the inner diameter to match the girth of the male genitalia while creating an elastic and soft interior (fig. 6). Before each use, Penrose tubing is tied with a washer-and-nut contraption and is fed through the foam interior of the device. The Penrose storage unit within allows for easy collection and extraction of semen samples (fig. 7). The device has been successfully introduced to the chimpanzee population and will serve to decrease anesthesia exposure and improve medical outcomes.

The successful development and implementation of the semen collection device shows the critical importance of collaboration within the community. The Global Center for Medical Innovation affiliated with the Georgia Institute of Technology was founded on the principle of accelerating medical innovation by pulling together the pieces of the medical technology ecosystem to drive innovation forward. What was experienced at Project Chimps and the collaboration between Georgia Tech students and the medical community could be reproduced between engineering universities and practicing physicians across the country. The experience exemplifies that with open lines of communication, some creativity and a cohesive effort, advances in medical technology innovation across all lines of species are possible. The opportunities are endless. ■

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