Fertility Rites

CHIMP SPERM MAY UNLOCK ONE OF THE RIDDLES OF HUMAN CONCEPTION. BUT FIRST YOU HAVE TO COLLECT IT.

By Jon Cohen

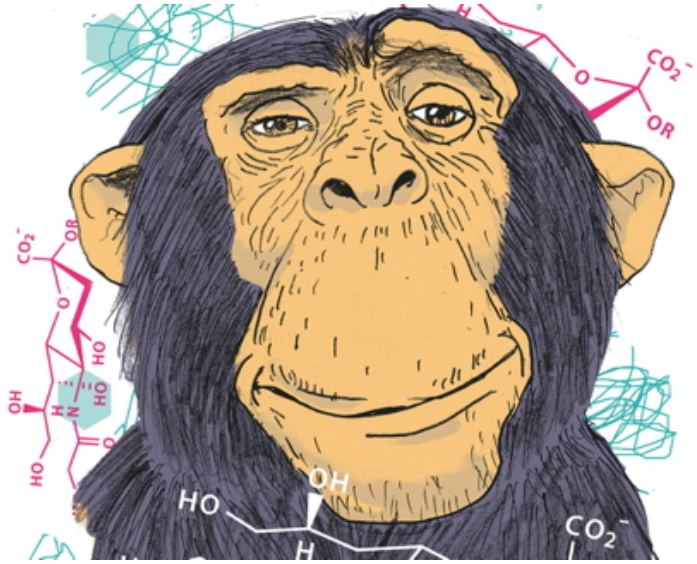

IMAGE CREDIT: MICHAEL BYERS/LEVY CREATIVE

PASCAL GAGNEUX, one of the few laboratory scientists who has studied wild chimpanzees, is a walking encyclopedia of chimpanzee/human differences. Ever since scientists began studying chimpanzees, they have emphasized our similarities, which *are* striking. But today, neither Darwinists nor conservationists need such similarities to further their respective causes: abundant genomic evidence supports Darwinian evolution, and laws and regulations are in place to protect all endangered species, regardless of whether they are cute enough to excite human sympathy. This has paved the way for chimp researchers like Gagneux to focus on what separates us from chimps. Their goal is to sharpen our understanding of what makes a human human.

In Gagneux's case, he and his colleagues are hoping to use their analysis of the differences between human and chimp sperm—especially the sugars that adorn the sperms' surfaces and let them bind to cells in the walls of the uterus or a fallopian tube—to unlock one of the riddles of human infertility: does sperm sometimes have components that undermine its ability to fertilize an egg? Perhaps the differences between chimp and human sperm can help explain why humans miscarry nearly 50 percent of all conceptions, while chimps seem rarely to lose an embryo or fetus.

To get at such questions, Gagneux has spent many hours fashioning devices to coax sperm from chimpanzees. He

began by sculpting a silicone version of a female chimp's rear end. But the male chimpanzees at the Primate Foundation of Arizona that were recruited to help with the project did not see it that way, and the model sat unmolested on a counter. "It's a nice chimp butt, but I thought it was a bonobo butt when I first saw it," Jim Murphy, the foundation's colony manager at the time, admitted to me when I visited a few years ago. "Maybe that's why they don't like it."

Gagneux's next attempt relied more on medical science than on art. He modified a piece of PVC pipe to create a variation on what's known as a Penrose drain, which is used to remove pus and other liquid discharge from wounds. For the chimps, the pipe was rigged with a compartment that holds warm water; latex coated with K-Y Jelly lined the interior.

On this day, Rachel Borman, who had worked at the foundation for 10 years as an animal handler, was given the job of selecting a sperm donor and encouraging him to produce a sample. Borman first "gowned up" to protect her clothes. The target donor today was a 16-year-old named Shahee. Borman asked me not to follow her into the space that held the caged chimps, as the presence of a stranger might break the mood. So I peered through the glass portal in a door. "I'm just going to go in there with these other guys to make him jealous," Borman told me as she entered the chimp space. She did a quick pass by Shahee's rivals and returned to the supply room for the modified Penrose drain. With it in one hand and a training clicker in the other, Borman walked toward Shahee. (Trainers use clickers in tandem with positive reinforcement, usually food, to condition animals to perform a specific behavior—in this case, masturbation.) After a few clicks, Shahee stuck his erect penis through the bars. Borman held up the PVC pipe and said, "Good boy! Good boy!" She then gave him an M&M, and walked back to the lab. "He did it," Borman said proudly.

Borman cracked open the tube. Lying on the tan latex was a chunk of chimp sperm about the size of a small wine cork. I say "chunk" because most of it had coagulated into what is known as a plug, about one-quarter of which usually melts in the warm vaginal vault. Using a Popsicle stick, Borman transferred the ejaculate into three vials. "It's fun for the chimps to do this," Borman explained as she capped the vials. "They love it."

My job was to shuttle the vials to San Diego when I flew home that night, and then drive them to Gagneux's lab at the University of California at San Diego so he could study them while the sperm were still alive. As we exited the enclosure, we passed Shahee. He spat on me.

On the way to the airport, I realized that the chimp sperm created something of a dilemma. I had the vials in my day pack, the only bag I had brought for my short trip to Arizona. If I wanted to carry the bag with me on the plane, I would have to pass it through security, and surely the screeners would question the liquid in my vials. What would I say? It was hair conditioner? Packed in laboratory vials? If I told the truth, would they think I was a modern Ilya Ivanovich Ivanov, the Russian scientist who tried to breed a "humanzee"? But if I checked my small day pack as luggage, would they suspect that I was a drug smuggler or some such, and escalate to a search and a humiliating outing?

I gambled that the security checkpoint was a higher risk, and I checked my day pack at the ticket counter. My bet paid off. Before I knew it, I was back in San Diego, sperm in hand, at a late-night rendezvous with Gagneux.

People tend to think of sperm as cylindrical, but they are actually paddle-shaped, Gagneux told me. "When they move around, they resemble a surfboard tumbling around in the waves," he said. He prepared some of the sperm I'd flown in, placing it on a microscope slide. The microscope was connected to a computer screen, so I could watch in real time. The sperm did not resemble surfboards tumbling in the waves so much as bugs flittering about on the top of a pond. "Wow, look at that," said Gagneux. "It's pretty sweet, huh? There's nowhere near that many in humans'."

Gagneux's lab space was adjacent to that of his collaborator Ajit Varki, who had helped uncover the functioning of the sugars, known as sialic acids, on cell surfaces. The sialic acids on the surfaces of human and chimp sperm have become the focus of Gagneux's work, too. Humans, as Varki discovered, have lost the ability to make one sialic acid, Neu5Gc, and Gagneux suspected that Neu5Gc played a role in fertilization. He hypothesized that Neu5Gc helped

female chimpanzees, in a process called “cryptic female choice,” get the benefit of the most-compatible, highest-quality sperm. The sugar acted like the fuzzy part of Velcro and attached to barbs formed by sugar-binding proteins on the surface of the cells in the uterus or fallopian tubes. Neu5Gc, as Gagneux imagined it, might “sweet-talk” the female reproductive system.

Gagneux’s Neu5Gc ideas had a critical implication for human fertility. Although we have lost the ability to synthesize Neu5Gc, we ingest the sugar when we eat meat and dairy products, and it, in turn, can then be incorporated into our cells. Does Neu5Gc coat the surface of human sperm? Is it found more readily on the sperm of men who eat lots of animal products? Does the extremely foreign Neu5Gc then trigger in women an immune response that selects against the survival of the sperm? “It could be that men who eat loads of meat pass a threshold and become infertile,” suggested Gagneux.

I left Gagneux shortly after midnight, and he was cranking away on the fresh chimp- and human-sperm samples he had received during the day. Science has few “Eureka!” moments, and Gagneux did not solve any great mysteries that night. But profound insights time and again come from asking simple questions that, once raised, seem abundantly obvious. *Do the different sugars on the surfaces of chimp and human sperm impact fertility?* is one of those obvious, beautiful questions. And it may just lead to an inobvious explanation for one of the more vexing problems that modern humans face.