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by Jeffrey Felshman

o one's watching the animals on a late December afternoon at the Milwaukee County Zoo, though the weather's mild. Several beasts are taking the air, but all the keepers are inside. You can see them through the Plexiglas window in front of the rhinoceros cages—a knot of five people in boots and sweaters grouped around a lean woman in a drab blue jumpsuit, Dr. Nan Schaffer, a Chicago-based exotic-animal veterinarian and researcher who's here to demonstrate a little of what she knows about rhino reproduction.

In the cage behind them a two-year-old male black rhino named Pombe is trying to get their attention. He pushes a tree stump with his snout. He trots to the back of his cage, spins, and then hurtles straight toward the bars. About halfway there he suddenly brakes and leaps straight into the air, all four feet off the ground at once—a vertical leap of about three inches. He hits the floor sliding and slams against the bars. "OK," Schaffer says, laughing. "We see you."

Schaffer is one veterinarian who makes cage calls. She does consulting work on all kinds of exotic animals—from lions to camels to gorillas—at zoos and sanctuaries all over the world, and she's a regular at the Sedgwick County Zoo in Wichita, Kansas, as well as at the Milwaukee zoo. She has also been on call at the Lincoln Park Zoo and the Brookfield Zoo as a veterinarian.

Schaffer's specialty is the physiology of rhinoceros reproduction, and no one in the world knows more

about it than she does. She's written or cowritten close to 100 professional articles on the subject. She's given numerous presentations, ranging from "Overview of Procedures and Results of Semen Collection From Ambulatory Rhinoceroses" (at the Milwaukee 200 in 1988) to "Gross Anatomy of Reproductive Structures and Their Ultrasonographic Images in the Rhinoceros" (at the First ICONTINUED ON PAGE 241

Dr. Nan Schaffer's crusade to breed rhinos may be the only way to save them.



International Symposium on Physiology and Ethology of Wild and Zoo Animals, in Berlin in 1996). Her fieldwork has been groundbreaking, the results she's achieved unique. Yet outside her field she's unknown. She's never been on Animal Planet or the Discovery Channel or a National Geographic special. She hasn't even been on Wild Chicago.

It's not that these shows shy away from animal reproduction—quite the contrary. But Schaffer's research requires her to get up close to male and female rhinos in a way that makes some people uncomfortable. There's more than one way, for instance, to go about collecting semen from a rhino, but the simplest and most practical is the most direct: the semen is coaxed out of him by hand. And that's something even zookeepers would really rather not talk about.

But then Schaffer preferred to remain unknown until two years ago, when she started SOS Rhino, a nonprofit organization funded through the rhinoceros reproduction program of the Milwaukee County Zoo that promotes research on all five species of rhinoceros and publicizes their plight. An SOS Rhino Web site appeared last year, complete with animated pictures of rhinos in the wilderness. The slogan on the site reads "Inform + Entertain + Empower."

The rhinos' situation is desperate. All five species-black, white, Indian (or Nepalese), Sumatran, and Javan-are on the world's endangered species list. The estimated total living in the wild is 11,370, with 6,500 white rhinos, 2,500 black, 1,900 Indian, 400 Sumatran, and 70 Javan. Schaffer has a particular affection for the Sumatran rhinos, which haven't adapted well to captivity, and wishes more people could see them before they disappear. She describes them as loners that live in the jungles of Malaysia and tend to shy away from people and each other. "They're small, woolly, personable," she says. "They talk in squeaky voices."

The rhinoceros is an "umbrella species,"

meaning that if it can survive in the wild, many other species can survive too. "It's pretty high up on the totem pole, on the pyramid of animals, because it is such a large species," says Schaffer. "If you save a species like that in its habitat, then you're saving a sizable area. You've got rhinos in savannas, you've got rhinos in jungle situations."

Much of the rhino's traditional habitat has been broken up by development. "When they start dividing up these areas-you'll have a little sanctuary here and a little sanctuary here and one over here, and you have all these people in between—the rhinos can't get to each other. That's a fragmented ecosystem." And transporting animals from one of these areas to another so they can breed isn't easy or cheap.

Rhino populations are declining everywhere but South Africa, which has aggressively protected its white rhinos. The illegal trade in powdered rhino horn in Asia has been a catastrophe. Rhino horn, crushed and bottled, is a folk remedy for a variety of ailments, though it's used mainly for impotence. Demand has a lot to do with its price, and in China one horn can sell for several thousand dollars. Studies show the powdered horn has no effect-which isn't surprising, given that it's made up of keratin (the same thing that makes up human fingernails) and compacted hair.

But the trade is entrenched, and the method of gathering horns is gruesome. "The poachers have to work fast," Schaffer says. "If they don't they get caught. So what they do is shoot the rhino with an AK-47, then cut off his nose with a chain saw." She says the poachers are often in such a hurry they don't bother to see if the animal is still alive before unleashing the chain saw.

Hoping to help save the species, zoos set up captive breeding programs. But they've had problems. For one thing, transporting rhinos of any species of either sex from one zoo to another is at least as difficult as transporting them in the wild. For another, rhinos càn be choosy when it comes to selecting a mate. And the breeding process itself is a titanic battle of the sexes that can lead to injuries, especially in a confined area. Moreover, the females often don't get pregnant.

And even when captive rhinos do get

pregnant they're more prone to complications than wild rhinos. In 1992 Schaffer went to Wichita to manage the pregnancy of an older rhinoceros named Bibi, a 31-year-old black rhino who'd had several spontaneous abortions (rhinos in their mid-30s are considered old). Bibi had given birth to two calves in her teens, but she hadn't delivered in 15 years. She'd been on loan from the Detroit Zoo since 1988 and had been bred they started chopping up her food. And it was hard to keep her vaginal infections under control."

Schaffer paid regular calls to Bibi's pen and devised treatments for each new problem that came up. Bibi became anorexic and depressed for a short period, but after being treated for an abscess on her toe she regained her appetite. and pleasant demeanor. She also had occasional skin ulcerations, which were treated



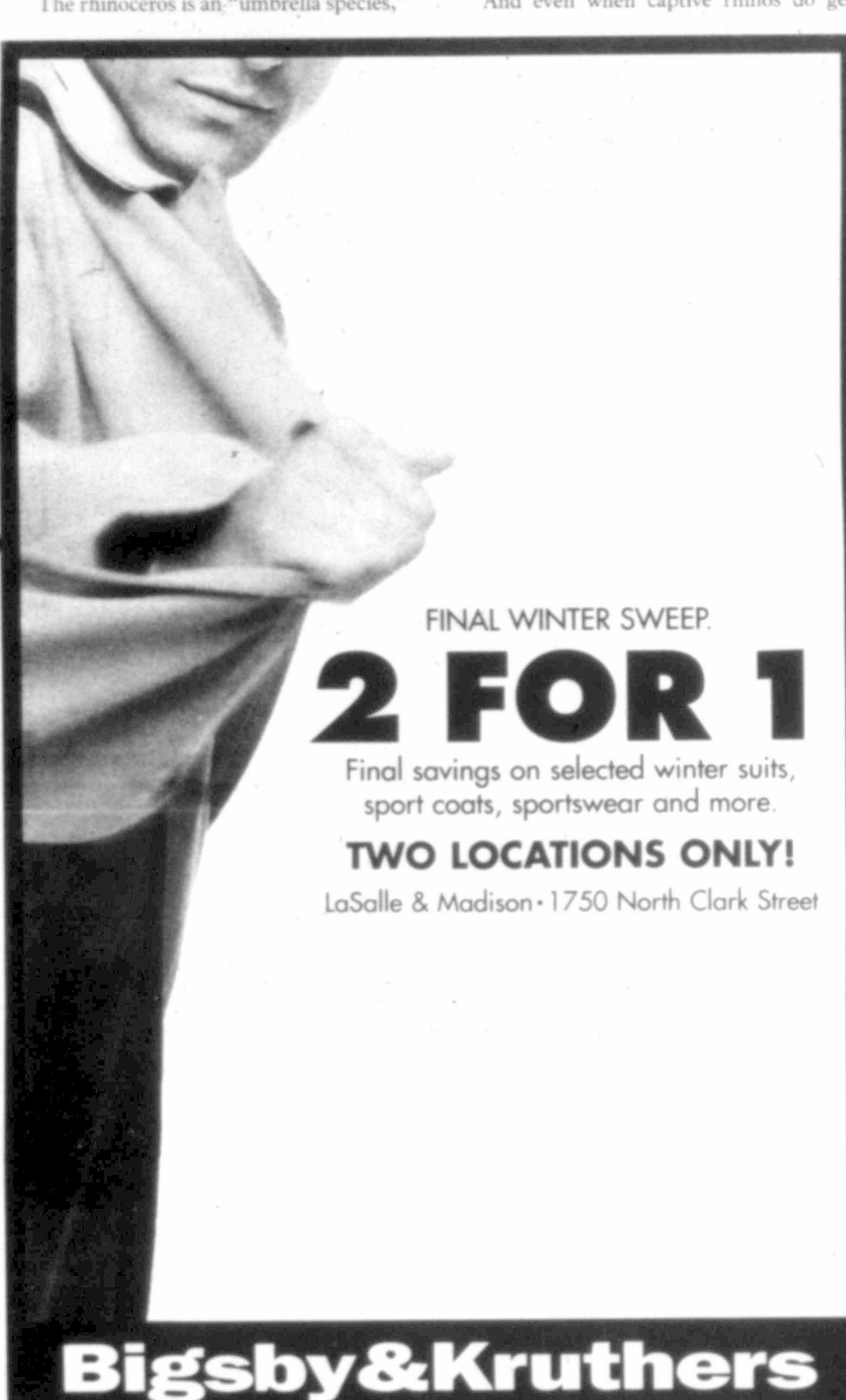
regularly to the same male. She got pregnant three times but aborted each time. Pregnancy in a rhino usually lasts between 14 and 16 months; Bibi's most recent pregnancy, in 1991, was over within 4. The zoo separated her from the male for a few months, and as soon as she was put back together with him she was pregnant again. Worried that she would abort again, the zookeepers called Schaffer.

The zoo put Bibi in a restraint chute so Schaffer could do an ultrasound, but the ultrasound didn't show anything. Bibi seemed in fine general health, though she did have a couple of problems. "Her teeth were bad, so

successfully with ointment. "We started supplementing her with progesterone," says Schaffer. She was also given molasses twice a day to raise her glucose levels.

"Through all this management she finally was able to maintain her pregnancy," Schaffer says proudly. "There's at least one more rhino in the world because of me." On August 16, 1993. Bibi delivered a healthy male calf. She was the oldest black rhino to give birth in captivity,

Though Bibi had gone a long time since having a calf, she was still a mother. "She actually became a little terror," Schaffer recalls. "She wouldn't let anybody in the barn



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or anywhere near this offspring. It took about a month for them to finally be able to get in there."

Given all the difficulties of breeding captive rhinos, and worried that time was running out-every time a rhino dies or is killed, one more unique set of genes is gone forever-Schaffer in 1981 began researching the potential for artificial insemination. But what seemed simple turned out to be not so simple after all.

One big problem lay with the mechanics of the insemination process. Fully erect, a rhino's penis extends up to two and a half feet and is shaped like a lightning bolt. To accommodate it, the reproductive tract of the female rhino is also quite long, with many twists and angles of its own that make it hard to get an inseminating probe into the uterus. Schaffer studied the reproductive organs of dead females, trying to devise a probe that could negotiate the curving tract. She tested several different models, but each one was stopped by the lotuslike folds of tissue that make up the cervix.

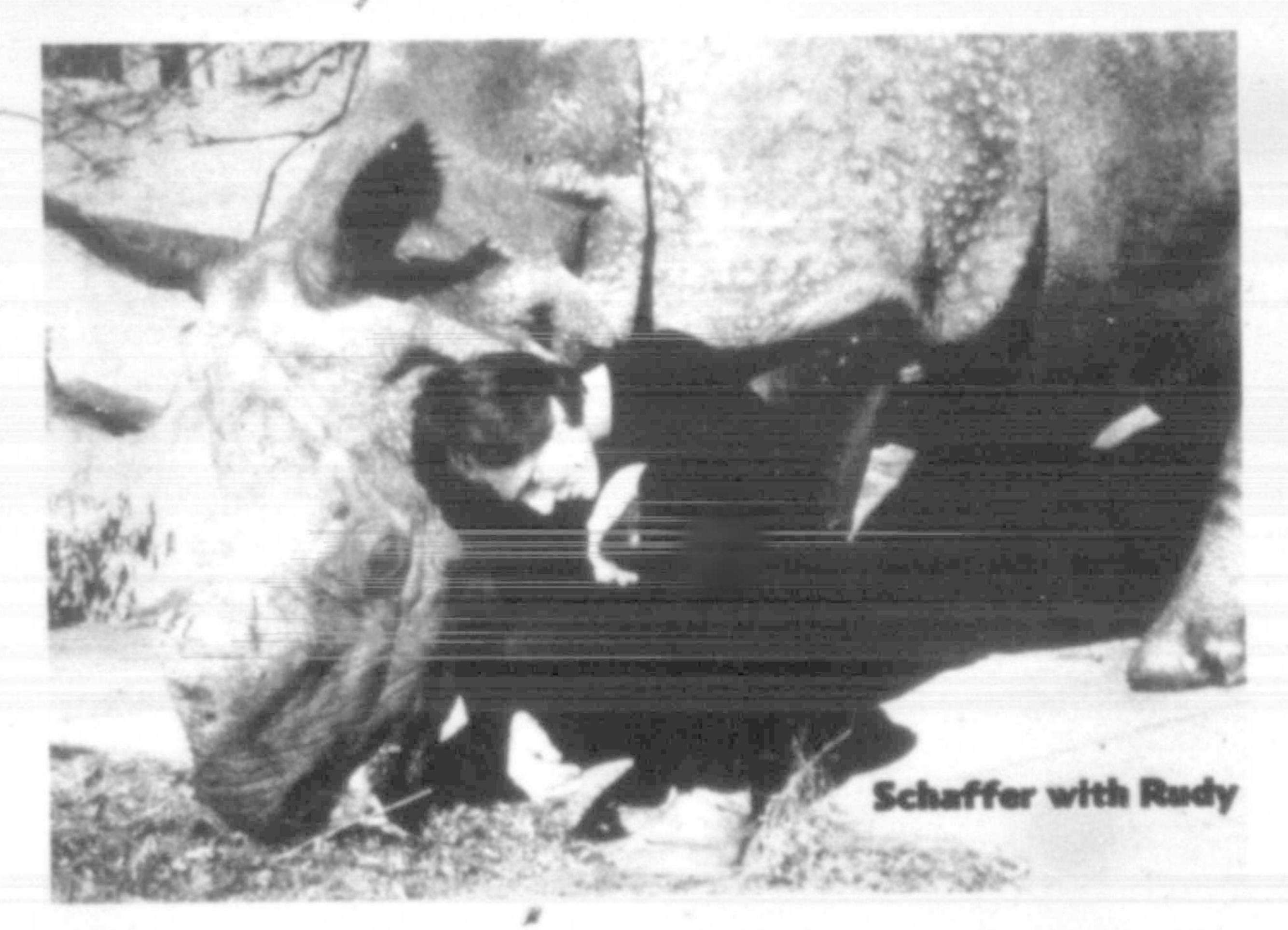
Schaffer might have thrown up her hands and admitted that nothing but a male rhino could impregnate a female rhino, but she now believes she's close to a solutionthough after a dozen years of trying, she's worried that she still might not get past the

Schaffer grew up on a dairy farm in Texas. Her father was a pathologist, her mother a horse trainer who managed the farm. Schaffer went to Texas A&M intending to become a veterinary technologist working on domesticated animals. But she soon realized, "With the vet-tech degree, l would have been overqualified for most of the jobs that were out there." In her sophomore year she took a trip to east Africa, and she soon knew she wanted to go back. One route was to focus on exotic animals.

In her last year at school Schaffer was

"I'm peeking around this corner and just seeing

this massive animal-and l'm gomna get in that cage with that



working with male gorillas, many of which were having a hard time breeding in captivity. They simply didn't know what to do with the females, she says. "They'd been raised alone and couldn't adjust to a female in the cage. Others were exposed to females they didn't like." As part of her research she collected semen samples to see if sperm counts were part of the problem, but she found that "some males had low sperm counts but managed to breed anyway." She

found plenty of reasons for the gorillas' breeding difficulties, but no overall solution. Yet she came out of the experience with a specialty: reproduction.

Reproductive studies of zoo animals constituted a new field in 1981, when Schaffer did her postdoctoral work in that area at the Bronx Zoo. She had no models to follow, so she spent a lot of time closely observing numerous animals-she even lived on the grounds. "One of my jobs at the Bronx was

trying to figure out how to determine pregnancy in these animals," she remembers. "They couldn't always tell." Many exotic animals don't show-for a good reason. "If you're out in the wild and a predator knows you're pregnant," Schaffer says, "he knows that you're a little slower than the rest of the

No one knew how to tell for sure where a female rhino was in her fertility cycle ei-

continued on page 26

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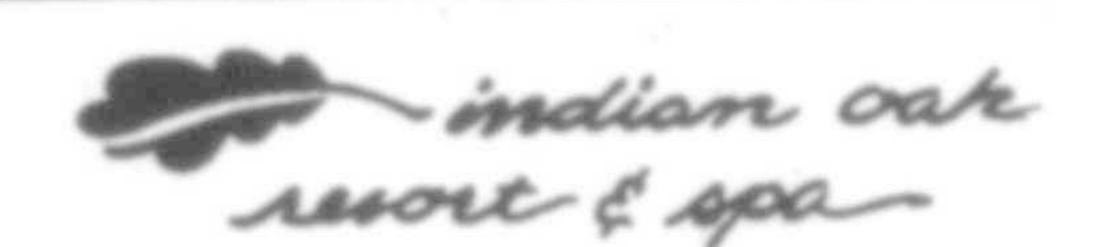
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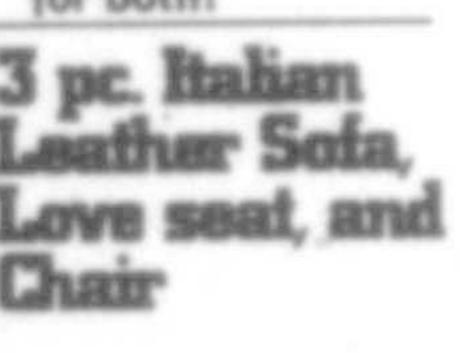
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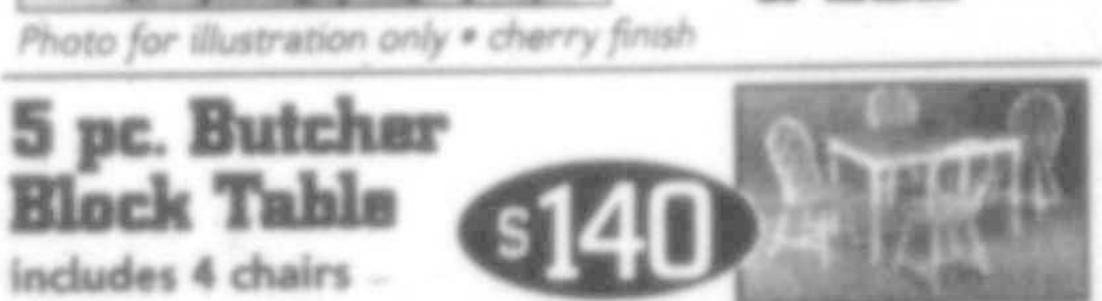
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ther. "My job was to hang around the rhino barn and wait for the female rhino to urinate so I could get a urine sample and test it for hormones." Schaffer was looking for a link between hormone levels and behavior, and

eventually she found one.

But when Schaffer wanted to start studying the possibility of artificial insemination in several species, zoo officials balked. Having grown up on a farm where the procedure was routine, Schaffer says, "It seemed perfectly natural to me, but in New York they were a little averse." She thinks they might have been worried about what the public would think or about being associated with any kind of research. "It means vivisectionists to some people," she says.

In 1982 she came to Chicago to act as a consultant. "Tom Meehan, who's now out at Brookfield, asked me to come and start a reproductive program on all the exotic animals in this area," she recalls. "At that time he was at Lincoln Park, and Lincoln Park was in the same mind-set [as the Bronx]. It took forever to convince them that a zoo needs to be a research institution." This too seemed perfectly natural-zoos are where the wild things are. If you can't learn from them there, where can you?

Schaffer got a grant to study rhino reproduction and was soon flying back and forth between zoos in the midwest, as well as Texas, Louisiana, and Maryland. She built restraint chutes that would allow zookeepers to easily take blood and fecal samples and do ultrasounds on pregnant females. She also provided more general veterinary care. Then she and Meehan, who had started an

artificial insemination program at the Saint Louis Zoo for the endangered Speke's gazelle, were invited specifically to do artificial insemination research at Milwaukee. "They almost immediately asked me to come work on their male Indian rhino," says Schaffer. "He didn't have a mate, and his back feet were bad, and they didn't think he'd be able to breed. They wanted me to get

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semen from him and preserve it."

She'd seen rhinos breed. It's a long ordeal, with much chasing, tossing, and pounding—even occasional goring. Rhinos' horns are hard and very sharp. Rhinos are in the horse family and can run in short bursts about as fast as a horse-but they weigh a lot more. During one breeding session at the Bronx Zoo, Schaffer had seen a male toss a female several feet in the air. "I didn't want to get in the middle of that," she says, "so I wasn't real sure what they were talking about at first."

And when she saw Rudy, the Indian rhino, she was even less sure. "Rudy was big for his species, and I'm peeking around this corner and just seeing this massive animaland there's no way I'm gonna get in that cage with that animal. But they said that he was quite agreeable and cooperative. He really let me come right into the cage."

She noted the quickest route to the exit and approached warily. She had no idea how long she'd stay in the pen. She was afraid she might get stomped-Rudy weighed upward of 4,000 pounds. She might get a sample, she might not. A straightforward approach had been successful with other kinds of animals she'd worked with, so that's what she intended to try first. She crouched partway under his belly. His knees buckled for a moment-the only time that would ever happen-but otherwise he barely moved.

"The first time he ejaculated he was in a full erection," Schaffer says, "and he ejaculated all this clear fluid. I said, 'Eureka, a sample!"" And that's when Schaffer ran up against the second big problem with rhino artificial insemination. The sample didn't

have any sperm in it.

Schaffer agreed to return once a week for a while and keep trying. A couple of months later, on Saint Patrick's Day, Rudy gave a sample with a little sperm in it. "We were all excited because we thought, well, this is really going to be it. We're going to get semen and freeze it, and it's just going to be wonderful. So we went out to the bar and drank green beer."

But the following week she got the clear fluid again. And the week after that. For a year. Then into another year. "He was a very patient beast," Schaffer says.

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She continued to drive up to Milwaukee

from Chicago once a week. "I knew sperm was there, because once in a while he'd give me a drop with sperm in it. I'd think, OK, now the gates are open." But they weren't.

Schaffer tried practically everything to get Rudy to come across with a usable sample. She tugged on him, squeezed him as if she were milking a cow. Once she did nothasked anyone about what the slender woman with the short hair was doing with Rudy the rhino. "I'd be out in the pen just working away, and the public would be out there watching me. I kept asking Bruce, who was the veterinarian at the time, 'Is this really a good idea?'" But no one said it wasn't. "Most people probably thought that Rudy

She soon discovered that she didn't even have to touch him to keep the samples coming: "He would get an erection at the sound of my voice. . . . I really had to get to his cage fairly quickly and get a cup under him or the sample was just lost."

ing but massage his rectum for an entire day. He ejaculated 400 cubic centimeters of fluid-without a single sperm in it.

Schaffer rigged up an artificial vagina that's commonly used for horses, which is just a big bag with warm water in it. "It was so heavy that we had to attach it to him to hold it up. So he had it roped to his belly. He was very patient with the whole process. He'd take a few steps, then he'd stop because he realized there was something on his belly. Then he'd take a few more steps, and it started flapping against his belly. He just didn't like that at all. So we finally had to take it off him."

Schaffer was doing all this during the day, during normal zoo hours, every week for two years. Spectators could see what she was doing, but no one ever said anything or

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was having a baby," she says. He wasn't even coming close.

One day in 1985, for reasons Schaffer still can't explain, Rudy gave a sample that was practically all sperm. She stayed calm. It could have been another false alarm. But the following week the same thing happened. And the next. "It was almost as if he learned to pass go. It didn't stop, and it came almost directly from the vas deferens and didn't mix with any accessory gland fluids. So it was high concentrations-in the billions. Billions and billions of sperm." Strangely, this fluid wasn't the result of his normal ejaculation, which was a hard spray, enough to fill a Dixie cup. "It was kind of a dribble at that point. Highly concentrated samples."

Stranger still, Schaffer soon discovered that she didn't even have to touch Rudy to

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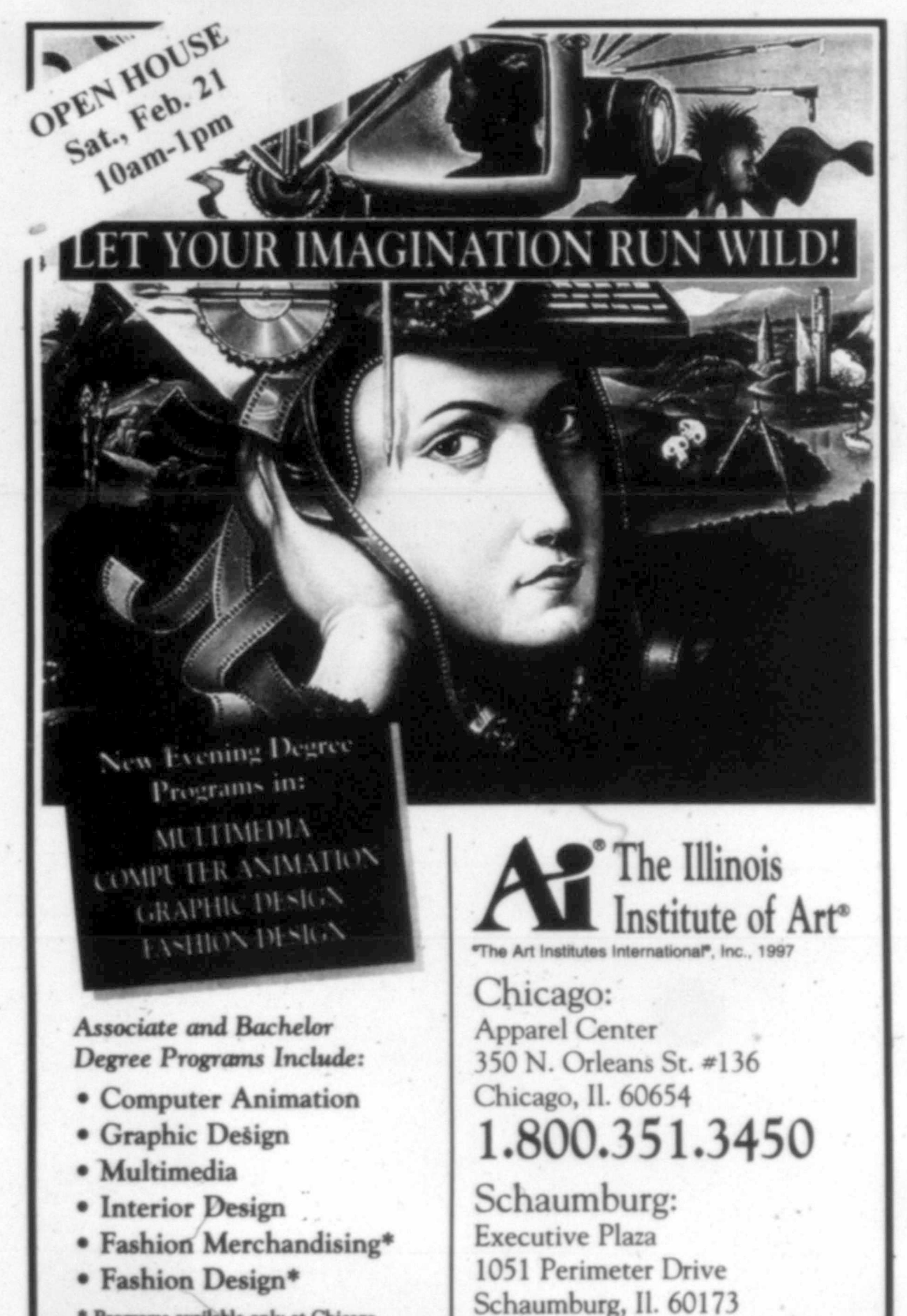
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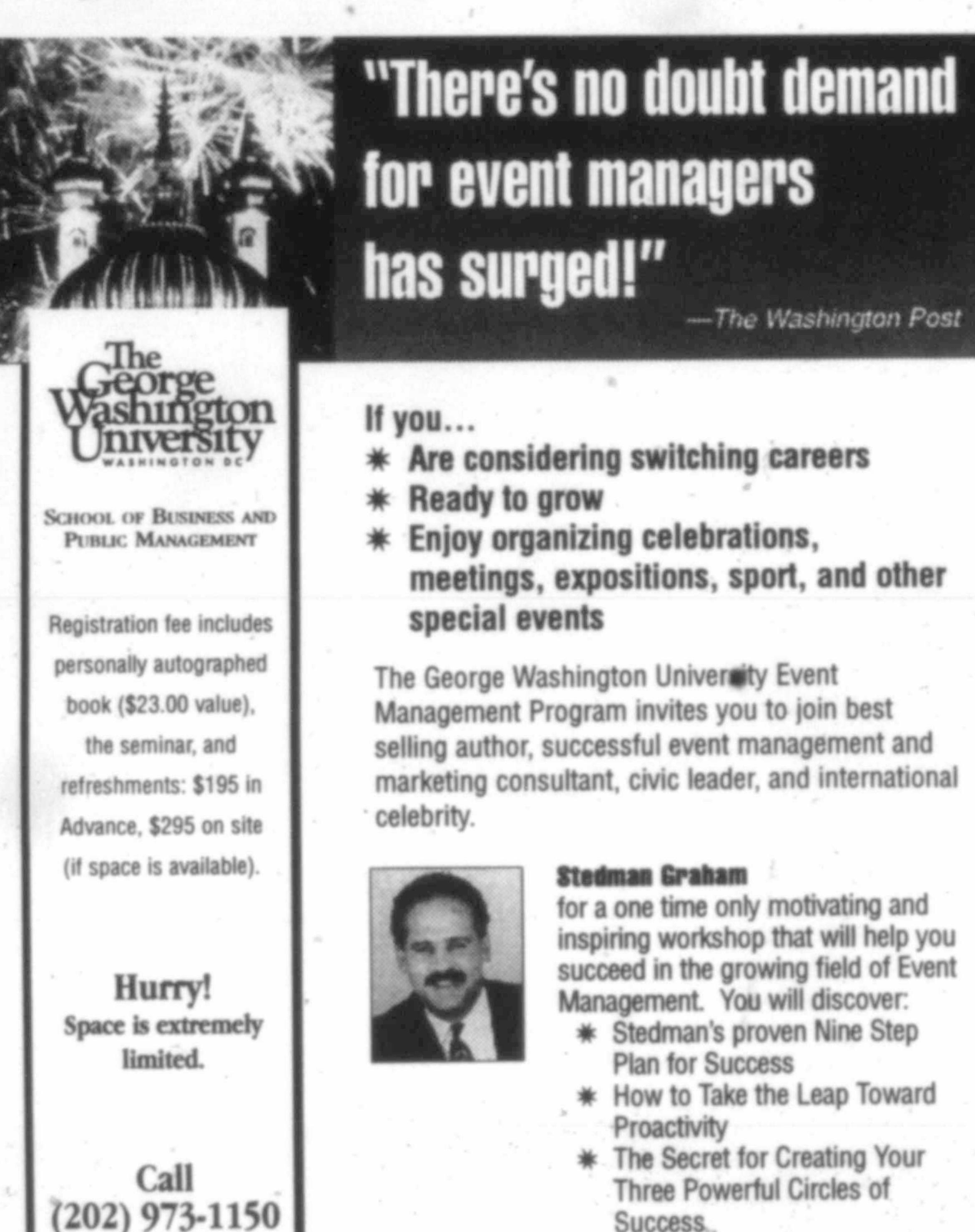
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keep the samples coming. "He was doing it himself," she says, shrugging. "He would get an erection at the sound of my voice, so when I hit the barn I really had to get to his cage fairly quickly and get a cup under him—or the sample was just lost."

Schaffer has worked with a lot of male rhinos since then, and like Rudy, they've been easy to manipulate and they almost always ejaculate, though more often than not the sample contains no sperm. (She doesn't know whether that's normal for mating males, but she says the species all seem to breed just fine in the wild.) But none of the males has responded to her voice the way Rudy did. She isn't sure why, though she does point out, "I haven't worked with any others for that long." And none of them has ever given anywhere near as much sperm. "It wasn't a normal ejaculate, obviously, because the two factions were separate from each other." She thinks that might be something characteristic of Rudy's species or simply of him. "I've worked on white rhinos for long periods of time and not even gotten anything at all."

Rudy is still the best rhino Schaffer's ever worked with. "My friends like to call him the perfect rhino."

In 1987 Schaffer was in Baltimore working with a bunch of macaques when she got a call about Rudy, who was then 33. His feet were worse, he'd developed sores all over his body, he was in awful pain. He would be put to sleep the following day. Schaffer was on the next plane.

When she walked into his cage, Rudy, pumped full of painkillers, was lying on his side. She'd never seen him like that, and she thought he almost looked dead. But when she walked over to greet him, he became aroused, just as he had for two years. "I said, 'No Rudy, not today.' He lost his erection. That amazed me, 'cause I fully expected him to get up, you know, and go through the whole nine yards. He did it every time."

Schaffer walked over to the side of the cage and just stood there looking at him. "He rolled up, got up—and it was very difficult for him to get up 'cause his feet had gotten so bad. He kind of started walking toward me and came up and put his nose next to the side of me and kind of pushed me. And I was like, OK? I just stepped over a lit-

tle bit. He pushed me again, and he did this all the way around the cage until he pushed me out the door. I was like, this is really bizarre. The veterinarian had gotten there by that time, and he said, 'It's time.' So they went ahead and euthanized him."

She still has a hard time talking about Rudy's death. "He was in terrible pain, and we knew that we were taking him out of his pain. But after we autopsied him we still weren't sure what the problem was, and that was the worst part—not knowing."

Since Rudy's death Schaffer has become a traveling emissary pressing for the establishment and protection of rhino preserves in Indonesia and India. In addition to starting SOS Rhino, she has lectured government officials about the necessity of enforcing the ban on the rhino-horn trade and instituted research programs from Madison to Malaysia.

She's now working with the Henry Vilas Zoo in Madison, the Sedgwick County Zoo, and the Milwaukee County Zoo, collecting semen from males that will never get a chance to breed and cryogenically freezing it for the day when she'll be able to use it. "They don't have mates," she says. "We have too many males now, and we have to save their genetic material. And this is really one of the options for doing that. I've been doing this for 15 years. I don't have another 15." She's also collecting sperm at Sungai Dusun, a part of the Malaysian national park system outside Kuala Lumpur, where she works with five Sumatran rhinos-a male and his harem of four females. And she has collected sperm from rhinos that have died at the Brookfield Zoo.

The benefits to humanity of saving rhinos from extinction are hard to quantify. Asked in a Web-site interview why she's working to save them, Schaffer answered, "No matter how hard we try, we cannot 'build' nature. We can build another bridge, paint another picture, but we cannot make another rhino. Look into a really wild animal's eyes. When the wild things are gone, we will lose our place, our way; for whose eyes will we look into to find our humility, our humanity?"

We've never lived on a planet that didn't have rhinos. Artificial insemination may or

may not save them. Schaffer worries about how people view her work in this area. "I'm trying to save these rhinos for posterity. People forget the purpose and just remember the process. But it has a higher purpose."

The amount of frozen rhino sperm that Schaffer has stored is still small. So on a mild December afternoon she's at the Milwaukee County Zoo teaching a veterinary student from Madison what she's learned about collecting it.

An entire family of black rhinos lives at the zoo. Brewster, Pombe's father, is placidly eating carrots in his cage. Barley is asleep in hers. Pombe, the rhino that leaped straight into the air and then slammed into the bars of his cage to attract Schaffer's attention, strolls off to the far end of his cage, backs up against the bars, and lets loose a hard spray of white, acidic urine.

"See all this mottling?" says a zookeeper named Dave. He points to white splotches all over the floor and up and down the bars of the cage. "That's all rhinos. We had elephants in here for years, and nothing. But put the rhinos in for a few months..." His voice trails off. Yet he and everyone else at the zoo agree that the two-year-old Pombe has very good manners.

Schaffer pats Pombe on the snout. Then she and the student step into Brewster's cage. Schaffer has been working with Brewster for a year, but he's never given enough sperm to freeze. This time maybe they'll get lucky.





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