In the Shadow of Jane Goodall

Fifty years after Goodall arrived in Gombe, the environment has changed dramatically for both our closest relatives and the scientists who study them

AFTER COMPLETING A MASTER'S DEGREE on banded mongooses in 1999, behavioral ecologist Emily Otali decided to stay at Makerere University in Kampala to pursue a Ph.D. She won a fellowship, which stipulated that she had to study the impact of forest destruction on blue monkeys. "I didn't like it," remembered Otali during a reporter's May 2008 visit to Uganda. The blue monkeys in question were not habituated to humans, so she thought she would get at best sketchy data from her 18 months of fieldwork; she preferred to continue her work on mongooses. She repeatedly complained about this to a documentary producer she was then working with on what would become the National Geographic video *Mongoose Murders*. One day when they were in the field at Queen Elizabeth National Park, he happened to spot Richard Wrangham, a primatologist at Harvard University who co-directs a research project on habituated chimpanzees in Uganda's Kibale National Park. "He dragged me to Professor Wrangham," Otali recalled.

Wrangham had been on the committee that selected Otali for the fellowship, and he recognized her name. Otali, who has a habit of cutting to the point, asked him why he and the other committee members forced her to study blue monkeys. Wrangham had an idea: Why didn't she come to Kibale for a day and see if chimpanzees interested her more? "Is there anything left to study in chimps?" replied Otali, who is a native of Uganda but had never seen chimps in the wild. "I hear Jane Goodall has been doing this all her life."

Online
sciencemag.org
Podcast interview with author Jon Cohen.

Wrangham, who began his own career working with Goodall in Gombe in 1970, at first just stared at her. "There's so much to do in chimps," he said.

Otali remained skeptical. "I thought nothing was going to take my heart away from mongooses," she said.

Nevertheless, she made the trip to Kibale, and it was, by her account, a boring day of "chimping." She observed just one infant, Ipassa, and her mother, and none of the other 50 chimps that live together in that part of the park. But one small incident had an indelible impact on her: She locked eyes with Ipassa. "Of course you're told not to make eye contact with chimps, but I stole that moment," she says. "It changed everything. I wanted to know more about these creatures that were so like me."

Otali went on to earn her Ph.D. at Kibale, studying the social dynamics of that chimp

CREDIT: MALCOLM LINTON

community. She was the first woman in Africa to earn a doctorate studying our closest relatives. Wrangham later appointed her to be the field manager of their Kibale study.

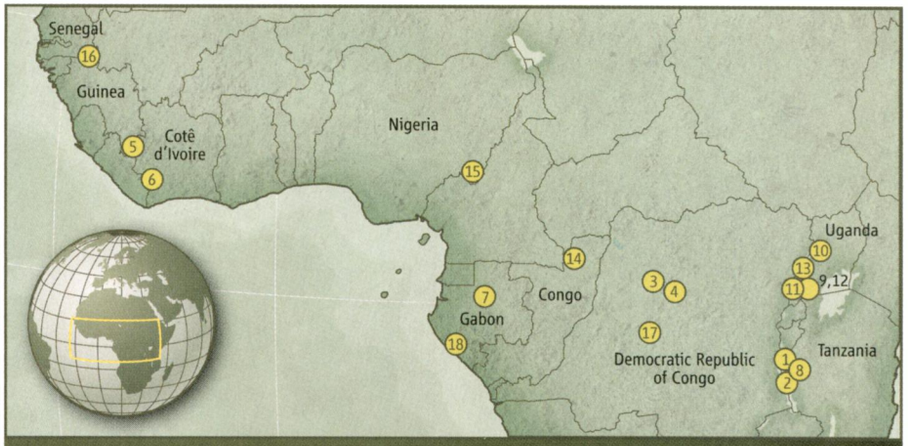
The new breed

Otali is one of dozens of a new crop of chimpanzee investigators *Science* met during the past 3 years in Africa, Europe, the United States, and Japan. They come from a variety of academic backgrounds and are pursuing diverse questions in both wild and captive chimps. But most share a powerful bond with their research subjects—sometimes too strong—and a conviction that studying our closest relatives provides unique insights into human evolution. "It's amazing staying with these animals and trying to understand what they think," says Paco Bertolani, a Ph.D. candidate at the University of Cambridge in the United Kingdom who is doing research in Kibale (p. 32). "You can see that 5 million years ago, we were similar to this creature. We'll never be able to enter their minds, but new experiments and observations can reveal aspects about them that have yet to be discovered."

Much has changed since Jane Goodall first visited what was then called Tanganyika to observe the Gombe chimpanzees. When Goodall took to the field in July 1960, no one had ever followed a group of chimpanzees in the wild and carefully documented the interactions of individuals, their diets, and their range. Goodall and the handful of contemporary researchers who soon began working in the wild created a discipline from whole cloth, making one head-twisting discovery after the next. Goodall changed the popular view of our closest relative through magazine articles, documentaries, and popular books like *In the Shadow of Man*. Similarly, studies of captive chimpanzees began to flourish in the 1960s, with primate centers receiving substantial government support and several academics even keeping animals on campuses and in their homes.

But, as Wrangham intimated, those pioneering studies just scratched the surface. Countless questions, of increasing complexity, remain about chimps—and how they compare to us. "The subtlety of the questions we're able to ask has increased, and there's a great deal of subtlety still left unexplored," says Jim Moore, an anthropologist at the University of California, San Diego, who also cut his teeth working at Gombe and now has many students helping him study savanna chimpanzees in Ugalla, Tanzania.

As Goodall showed, wild chimps use tools, but researchers continue to discover



LONG-TERM CHIMP AND BONOBO RESEARCH SITES

1 
Site: Gombe Stream Research Centre, Tanzania
Lead Researchers: Jane Goodall Institute
Began: 1960

2 **Site:** Mahale Mountains Chimpanzee Research Project, Tanzania
Lead Researcher: Toshisada Nishida, Japan Monkey Centre
Began: 1965

3 **Site:** Lomako (bonobos), Democratic Republic of Congo
Lead Researcher: Jef Dupain, African Wildlife Foundation
Began: 1974

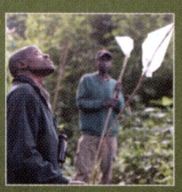
4 **Site:** Wamba (bonobos), Democratic Republic of Congo
Lead Researcher: Takayoshi Kano, PRI
Began: 1974

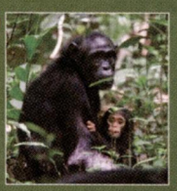
5 
Site: Bossou-Nimba Chimpanzee Research Project, Guinea
Lead Researcher: Tetsuro Matsuzawa, PRI
Began: 1976

6 **Site:** Taï Chimpanzee Project, Côte d'Ivoire
Lead Researcher: Christophe Boesch, MPI-EVA
Began: 1979

7 **Site:** Station d'Etudes des Gorillas et Chimpanzees, Lope Reserve, Gabon
Lead Researcher: Kath Jeffery, Wildlife Conservation Society
Began: 1984

8 **Site:** Ugalla Primate Project, Tanzania
Lead Researcher: Jim Moore, Univ. Calif., San Diego
Began: 1985

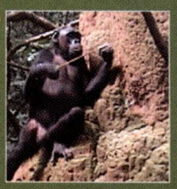
9 
Site: Kibale Chimpanzee Project, Uganda (Kanyawara Community)
Lead Researchers: Richard Wrangham, Harvard Univ.; Martin Muller, Univ. New Mexico
Began: 1987

10 
Site: Budongo Conservation Field Station, Uganda
Lead Researchers: Fred Babwateera, Makerere Univ.; Klaus Zuberbühler, Univ. St. Andrews
Began: 1990

11 **Site:** Kalinzu Forest Reserve, Uganda
Lead Researcher: Chie Hashimoto, PRI
Began: 1992

12 **Site:** Kibale National Park, Uganda (Ngogo community)
Lead Researchers: John Mitani, Univ. Michigan; David Watts, Yale Univ.
Began: 1995

13 **Site:** Semiliki-Toro Wildlife Reserve, Uganda
Lead Researcher: Kevin Hunt, Indian Univ.
Began: 1996

14 
Site: Goualougo Triangle Ape Project, Nouabalé-Ndoki National Park, Congo
Lead Researchers: Crickette Sanz, Univ. Washington St. Louis; David Morgan, Lincoln Park Zoo
Began: 1999

15 **Site:** Gashaka Primate Project, Nigeria
Lead Researcher: Volker Summer, Univ. College London
Began: 1999

16 
Site: Fongoli Savannah Chimpanzee Project, Senegal
Lead Researcher: Jill Pruetz, Iowa State Univ.
Began: 2001

17 **Site:** LuiKotal (bonobos), Democratic Republic of Congo
Lead Researcher: Gottfried Hohmann, MPI-EVA
Began: 2002

18 **Site:** Loango National Park, Gabon
Lead Researchers: Christophe Boesch/ Martha Robbins, MPI-EVA
Began: 2005

MPI-EVA: Max Planck Institute for Evolutionary Anthropology
PRI: Primate Research Institute, Kyoto University
*Some sites only operate intermittently, not all have habituated apes, and lead researchers are not necessarily the founders.

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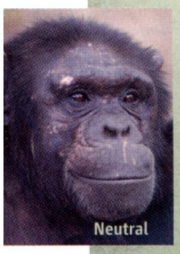
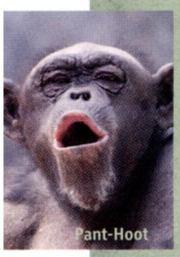
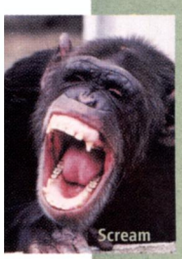
Chimps Read Lips





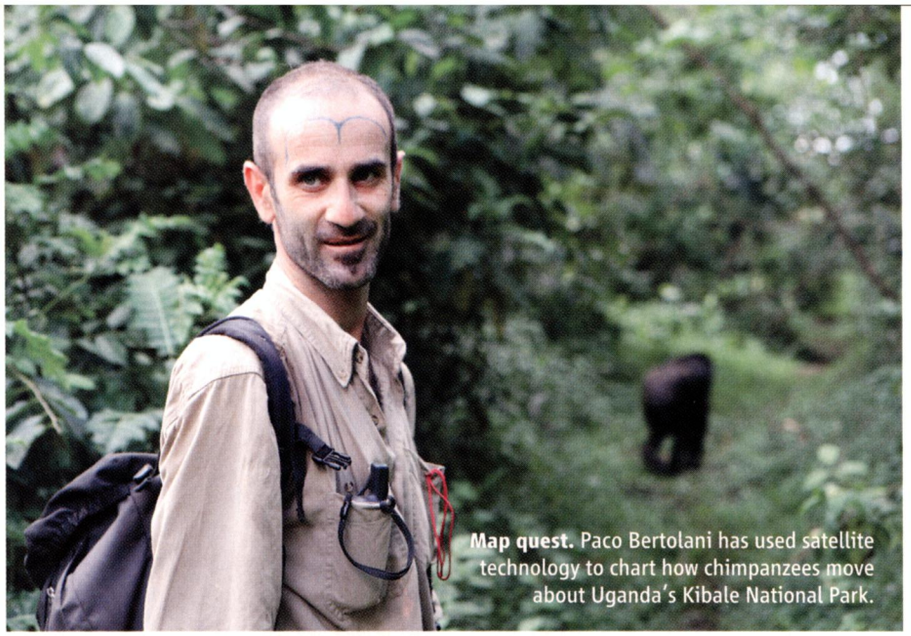


ATLANTA—In 1862, French neurologist Duchenne de Boulogne published *The Mechanism of Human Facial Expression*, which linked specific facial muscles to emotional states such as aggression, surprise, and lasciviousness. More than 150 years later, comparative psychologist Lisa Parr of Yerkes National Primate Research Center is trying to make the same connections to the puckered lips, raised eyebrows, and grins of chimpanzees. "It's just been a really ignored area," Parr says.

Whereas psychologists who study chimpanzees argue endlessly over whether they can understand the intentions and desires of others—the so-called theory of mind—Parr says that debate is too arcane for her tastes. Facial recognition, in contrast, is elemental. "We're starting at the bottom and working up," Parr says. In the process, she has helped to develop an elaborate system that objectively classifies expressions and the muscles that are involved.

Parr is part of a consortium that has created a chimp Facial Action Coding System, which builds on work done in humans in the 1970s. After studying facial muscles dissected from dead chimpanzees, Parr and her colleagues electrically stimulated the muscles in anesthetized live chimps, defining nearly two dozen "action units." Other studies use a joystick-controlled computer to see how chimps interpret different expressions. They are shown three photos of chimps and asked to match the two that have the same facial expression. She's also scanning the brains of living chimps to see how the neural-processing networks compare with those in humans, looking for clues to how human communication evolved; her results suggest that chimps use the same regions of the brain to process faces as humans do—and these regions differ dramatically from the ones used by monkeys. –J.C.

Look here, chump. Facial expressions speak volumes about emotional states.



Map quest. Paco Bertolani has used satellite technology to chart how chimpanzees move about Uganda's Kibale National Park.

Makoku at 0°30′N 30°24′E: Chimping Via GPS

KIBALE NATIONAL PARK, UGANDA—With the help of satellites, a handheld GPS device, and his laptop, Paco Bertolani has put together a map that redefines the art of charting chimpanzee life in the wild. As part of his Ph.D. dissertation for the University of Cambridge in the United Kingdom, Bertolani is analyzing the routes chimpanzee use in different habitats. His goal is a better understanding of how chimps orient themselves and save energy. Nearly every day from October 2007 to June 2009, Bertolani followed a different male in the habituated chimp community here, starting in the early morning and ending at nesting time at dusk.

During an outing one day in May 2008, he noted the location of the chimp-of-the-day, Makoku, every 10 meters with the GPS device, and he also mapped the fruiting trees that attract many in the community, tracking how movements change with the availability of different foods. He then overlaid these data on satellite images of the terrain, creating something of a Google Map of the popular pathways, dining spots, and places to sleep. "The GPS in the forest historically has never worked," said Bertolani, noting that new and improved receivers on the ground can finally receive signals from satellites through the thick forest canopy. "So it's never been possible before now to do such a detailed study of ranging." –J.C.

surprising new variations on that theme. More intensive comparisons of different wild sites are documenting a bevy of unique "cultures," from nut-cracking to grooming techniques, in different communities. Researchers have moved beyond teaching apes to communicate (p. 38) to refined studies of vocalizations in both wild and captive chimps (p. 36), an area that has received scant attention. Long-term data amassed in the field and at primate centers and zoos are filling in gaps in information about life span, social structure, reproduction, and disease. Carefully constructed lab experiments are uncovering new insights about cooperation, empathy, and teaching. Comparative work is also taking place with bonobos, the chimp cousin that is equidistant from humans on the family tree.

Today, researchers operate in a different landscape, both in terms of where and how chimps are studied. They have many advantages. For one, several sites have habituated wild communities, which means a student can go to the field and immediately start a research project. New technologies have had an even broader impact, enabling researchers in both wild and captive settings to explore questions they could not have probed 50 years ago. The chimp genome is now available, and more routine DNA sequencing has exposed occult infections like the chimp AIDS virus, SIVcpz, and complex familial relations. Experiments with captive apes using touch-screen computers reveal new dimensions in their cognitive capacities. Global imaging systems help primatologists precisely chart animal movements and habitat. Magnetic resonance imaging scans of captive chimps are clarifying how their brains differ from ours (p. 40).

Just as technology has broadened the research possibilities, lines that once separated groups have blurred. Although some young researchers complain that their mentors are still territorial with each other and their animals—"They're behaving more

CREDITS (TOP TO BOTTOM): MALCOLM LINTON; PHOTOS.COM (2); ISTOCKPHOTO.COM, PHOTOS.COM; ISTOCKPHOTO.COM; PHOTOS.COM

and more like chimpanzees," one graduate student groused—several study sites have pooled data. A growing number of investigators have studied both captive and wild chimps. Scientists who oppose invasive biomedical research with chimps now do laboratory examinations of noninvasively acquired blood, hair, feces, and urine. "In the coming decades, we need the interdisciplinary approach to get to know chimpanzees better," says Tetsuro Matsuzawa, who heads the Primate Research Institute of Kyoto University in Inuyama, Japan (p. 41) and also runs a field study in Bossou, Guinea. "You should pay attention to both laboratory and field research. If you're interested in genetics of great apes, you should go to Africa to see the reality."

Nowhere embodies the cross-disciplinary approach more than the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, which opened in 1997 and hired topnotch researchers in genetics, psychology, primatology, and paleontology who study chimpanzees and bonobos in the wild and in captivity (*Science*, 17 August 2001, p. 1246). "Our main argument—and why this institute exists—is if you want to understand human uniqueness, you have to understand our closest relatives," says Christophe Boesch, who heads the primatology department and has conducted studies of wild chimpanzees for 3 decades.

In 2001, Max Planck opened the Wolfgang Köhler Primate Research Center at the Leipzig Zoo, the only facility in the world where investigators can study chimps, bonobos, gorillas, and orangutans. "This is a place where if you have an idea, the next day you go test it," says psychologist Josep Call, the center's director. "It's really unbelievable."

Opportunity knocks

As new technologies and intersecting disciplines expand the study of chimpanzees and bonobos, researchers are also grappling with a daunting constraint: These endangered species are dwindling in numbers, both in captivity and in the wild. Funding to study them is also fickle.

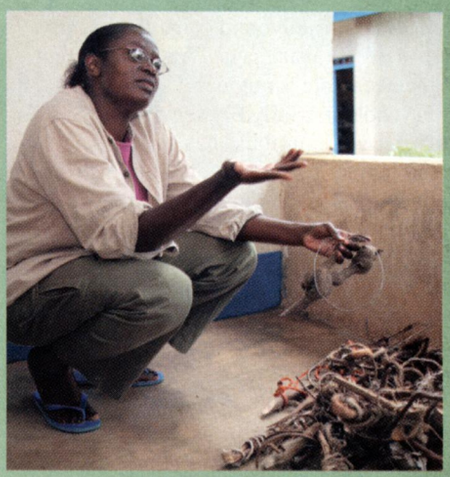
The captive population available to scientists for the past 15 years has steadily declined because of concerns in several countries about the ethics and value of sometimes harmful biomedical studies; many former "research chimps" have been "retired" to sanctuaries that forbid their use in any scientific studies, including noninvasive ones (*Science*, 26 January 2007, p. 450). The U.S. National Institutes of Health (NIH), which since 1960 has been

A Matter of Life and Limb

KIBALE NATIONAL PARK, UGANDA—The chimpanzees here are not threatened by poachers for bushmeat. But they face another peril: Many become entangled in snares set in the forest for other animals such as duikers. Typically made from sticks and the wire used on motorbike brakes, the snares lie on the forest floor and cinch on limbs when an animal steps inside them. Chimps often tighten the wire in a frantic attempt to remove it, cutting off the blood supply to their limbs. Sometimes the limbs rot off and then heal; sometimes the animal dies from infection.

Up to one-third of the chimps at Kibale have become entangled in snares, and Max, a 12-year-old male, is one of the most tragic. After losing one leg to a snare, he became caught again and lost his remaining leg. "It's really, really heartbreaking," says Emily Otali, the field manager for the Kibale Chimpanzee Project. "When Max lost his first leg, he was a sport about it," Otali says, explaining that he limped on his good leg, and the stump quickly healed. "Then he lost his other leg, and he had to use his former stump, and he bruised it and it was bleeding, and the new one was bleeding," she said. "He sat on the tree whimpering." Max now crawls about on his two stumps and still climbs trees. "He's not a happy chimp, but he's alive," Otali says.

The Kibale team has hired hunters from local villages to work with them to remove snares; they also try to teach the villagers about the chimpanzees, hoping that if they know more about them they will care more about their well-being.



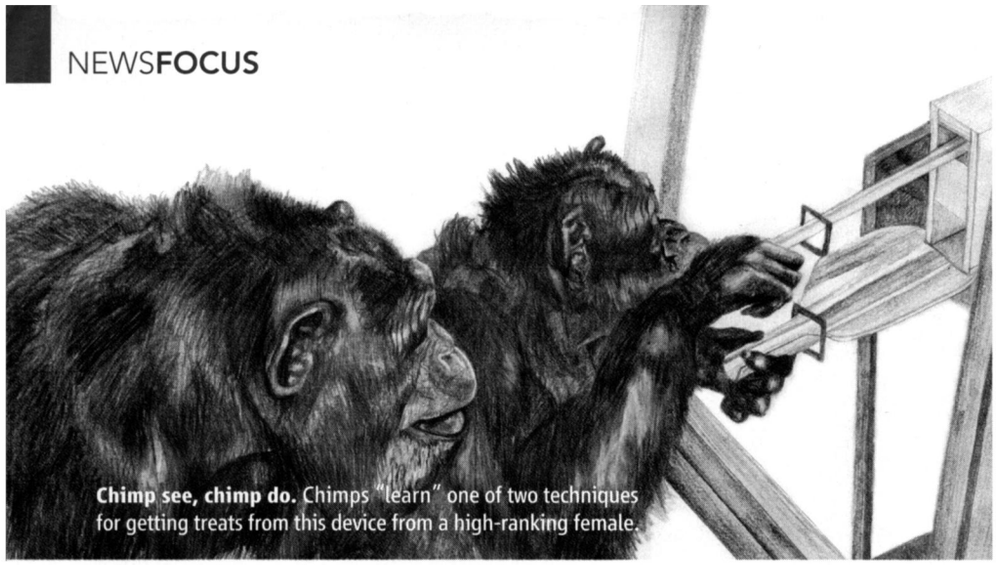
Trap tragedy. Kibale's Otali (*bottom*) has a snare-removal team, but Max (*above*) still lost both his legs within the same year.

Across the country in the Budongo Forest Reserve, a similar percentage of chimpanzees has lost limbs to snares, leading the researchers there to try a creative intervention with local hunters: In exchange for agreeing not to use their snares, the hunters each receive two goats and veterinary care for them. With funds from California's Oakland Zoo, Budongo now hires four people to remove snares, and they've seen the numbers drop dramatically. "It's had real success," says Vernon Reynolds, a retired anthropologist from the University of Oxford in the United Kingdom who started the Budongo chimp research project. The Jane Goodall Institute also has a snare-removal program that employs former poachers and educates locals.

But the battle never ends. "I don't know if it's a no-win situation," says Otali. "We just have to continue, hoping to make a change, no matter how small it is."

–J.C.

CREDITS (TOP TO BOTTOM): KYLEB WILD; MALCOLM LINTON



Chimp see, chimp do. Chimps "learn" one of two techniques for getting treats from this device from a high-ranking female.

The Spread of Culture, Primitive as It Is

LAWRENCEVILLE, GEORGIA—It wasn't until 35 years ago that chimp researchers from Gombe visited the nearby project in the Mahale Mountains and noticed a startling difference in grooming techniques. This led to the idea that chimpanzee communities had unique "cultures," but field studies have had difficulty proving that chimps transmit social behaviors. So in 2003, with a freshly minted Ph.D. in hand from the University of St. Andrews in the United Kingdom, Victoria Horner came to Yerkes National

a major supporter of captive chimp populations for research, no longer funds breeding, which means the 1000 or so research chimps now in U.S. primate colonies will disappear within 30 years, according to one estimate (*Science*, 26 January 2007, p. 450). "It's a big concern," says Frans de Waal, an ethologist at Emory University in Atlanta.

De Waal studies chimps at the nearby Yerkes National Primate Research Center, which Emory has run for many years with substantial NIH support. Yerkes is now one of the only places left in the United States that houses chimpanzees for behavioral and cognitive research. "We have to fight here to keep the colony alive and going for research purposes," de Waal says. "And the current financial climate is not ideal."

Psychologist Sally Boysen of Ohio State University, Columbus, has an especially bleak view of the future of captive chimp studies. "It's pretty grim," says Boysen, who for more than 20 years had chimps on campus until her university said in 2006 that it no longer had enough funding to keep them. Despite Boysen's loud protests, she had to let go of her nine chimps, and the six surviving ones now live at Chimp Haven near Keithville, Louisiana, a sanctuary for retired research animals. "The message for all of us is, 'Hey, it's not worth it to focus your career on this,' " Boysen says. She also laments what she sees as "the convergence of the animal-rights movement and the political zeitgeist" undercutting the value of chimp research.

The Max Planck model of linking zoos to academic institutions may become more commonplace. The Edinburgh Zoo in the United Kingdom opened the state-of-the-art Budongo Trail exhibit in May 2008 that has 40 chimps and welcomes researchers from the University of St. Andrews. The zoo also supports field studies in Budongo, Uganda. "Zoo funding is better than research grants because zoos are going to stay there and keep funding you if they like your work," says Vernon Reynolds, an anthropologist emeritus at the University of Oxford who started the Budongo project in Uganda. "A grant is up in 3 years."

Some zoos also allow academics to do research without directly supporting them. But this has its limits, cautions de Waal, who did groundbreaking chimp work at Burgers' Zoo in Arnhem, Netherlands, and bonobo studies at the San Diego Zoo. "Zoos can be very constraining," he says.

Biological anthropologist Brian Hare of Duke University in Durham, North Carolina, has opened a new avenue for studies by tapping into the African sanctuaries that now house bonobos and chimpanzees, many of them confiscated from animal traders or orphaned when their mothers were slaughtered by bushmeat hunters (*Science*, 7 September 2007, p. 1338). According to the Pan African Sanctuary Alliance, more than 850 chimps now live in sanctuaries there, which is more than all the chimps in Europe's zoos and three times the number held by accredited U.S. zoos. "Sanctuaries are the future for ape research," Hare says. "We have far better research resources for a fraction of the cost, and we are helping conservation and welfare organizations on the ground in ape-habitat countries while training African researchers."

> *"Sanctuaries are the future for ape research. We have far better research resources for a fraction of the cost."*
>
> —BRIAN HARE, DUKE UNIVERSITY

Long-term sites where researchers study wild chimpanzees and bonobos have nearly doubled during the past decade (p. 31), but given the rapid pace of the populations' decline from habitat destruction, the bushmeat trade, and disease—some transmitted from humans—many researchers worry that their days are numbered, too. Boesch, who has studied wild chimpanzees in the Taï National Park in Côte d'Ivoire since 1979, argues that the need for more long-term field studies is urgent. "Whenever we go to look, we observe new behavior in chimpanzees that we didn't know before," says Boesch, who recently started a project in Gabon. As the wild chimp population dwindles—the best estimate now puts the population at 200,000 to 300,000 individuals—those opportunities are lost forever, he says.

One particularly productive new site is the Goualougo Triangle Ape Project in the Nouabalé-Ndoki National Park in the Republic of Congo. The remote area, which has 1000 gorillas and 500 or so chimpanzees in more than a dozen communities, wasn't studied until David Morgan went there in 1999. "Ndoki was one of the best kept secrets," says Morgan, who is now a fellow at the Lincoln Park Zoo in Chicago, Illinois, and runs the project with his wife, biological anthropologist Crickette Sanz of Washington University in St. Louis. "We've had more observations of chimps and gorillas interacting than anyone." They have also taken advantage of several high-tech tools, setting up sensor-activated video cameras at termite mounds and fruiting trees and sensors to help detect poachers.

The new generation of chimp researchers has one other trove of data to mine: Studies can now be done with little more than a computer and an Internet connection. Anyone can scour the chimpanzee genome and compare it to those of other species. The recently launched Center for Academic

CREDIT: DRAWING BY AMY WHITEN

Primate Research Center of Emory University to exploit its unique culture: Its 47-hectare field station in this Atlanta suburb houses two groups of chimps that live in separate but nearly identical conditions, an ideal experimental setting to study transmission of culture in a controlled environment. "There's no other facility in the world like this," says Horner, who works here with Frans de Waal of Emory.

Two years after arriving, Horner, de Waal, and her then–postdoc adviser Andrew Whiten of St. Andrews published a landmark study that provided the most convincing evidence yet that a new "culture" could spread through groups of chimpanzees. The experiment resembled the children's game "Telephone," in which a message is passed down a chain of individuals. In this case, they taught one chimp in each group how to use a new tool and assessed whether the technique—the culture—spread.

The study relied on a clever device that held a treat, which the chimps could retrieve by either lifting a handle or poking a release lever. Horner taught one high-ranking female in each group a different method. As she and her co-authors described in the 29 September 2005 issue of *Nature*, the other chimps observed their "local expert" and copied the technique. The team subsequently published similar studies that taught one individual in each group to either slide or lift a door in a box that held fruit, or to gather tokens and place them in either a bucket or a pipe to receive a food reward. These experiments again demonstrated that the behaviors were transmitted in their respective groups, creating cultures.

Yes, human culture is much more sophisticated, Horner acknowledges. But she says these experiments unequivocally demonstrate that the ability to transmit a culture is not uniquely human, as some anthropologists have argued. "At what point are people going to be able to give up and say, 'Yes, we are apes,' and be able to handle that?" she asks.

–J.C.

Research and Training in Anthropogeny at the University of California, San Diego, is currently digitizing and putting online one of the largest collections of chimpanzee skeletons ever available for study (p. 43). Although they are not public, many long-term sites have massive amounts of data that researchers can probe. Anne Pusey, a behavioral ecologist at Duke University who formerly ran the Gombe site for the Jane Goodall Institute, says they have 600 hours of videotaped recordings over 11 years of 100 or so wild chimps in three different communities. "We've only looked at the tip of the iceberg," Pusey says.

Perhaps the most pronounced change that has occurred since Goodall first wowed the world with her Gombe observations is one that she ushered in: Protecting chimps is now intimately tied to research. Today, many researchers who complete their Ph.D.s find themselves having to choose between conducting further studies and moving into conservation full-time. And those who stay in research face a different ethical landscape from the one their predecessors faced, in terms of the types of experiments they can conduct, the housing they provide captive chimps, and their responsibility to protect the wild communities they study. "I've seen radical changes," says Masaki Tomonaga, who for 2 decades has studied chimp cognition at Japan's PRI. "Twenty years ago, most researchers didn't think about the ethical issues and the future of these animals. Now we have such an accumulation of findings about them and such a high level of understanding, we have to apply them to animal welfare and conservation. This research is to better understand humans and chimpanzees, but it also has to be used to conserve their lives for the next generations."

–JON COHEN

The Chimpanzee Genome Project's Seedy Origins

WHEN THE HUMAN GENOME PROJECT SET out to unravel the entire DNA of *Homo sapiens*, researchers decided to take blood and sperm from donors with diverse backgrounds to create a "consensus" sequence. The hundreds of donors recruited for the project did not know whether their DNA made it into the final sequence, and the scientists were blinded to the identity of the donors. For the Chimpanzee Genome Project, the DNA came mainly from one chimp, Clint, of Yerkes National Primate Research Center in Atlanta, and he was chosen for the most haphazard of reasons.

DNA donor. Clint was chosen to represent the genetics of his species for an X-rated reason that had nothing to do with his chromosomes.

CREDIT: YERKES NATIONAL PRIMATE RESEARCH CENTER

For his Ph.D. thesis at Baylor College of Medicine in Houston, Texas, in the 1990s, Evan Eichler studied stretches of DNA that repeat themselves, which are tricky to sort out from sequencing errors. After he completed his doctorate, he wanted to unravel a particularly confusing repeat on the human X chromosome, which he thought he could sort out by comparing it with chimpanzee DNA. The process required a few scientific tricks he did not know—specifically, the then-new technique of cloning stretches of DNA into what are known as bacterial artificial chromosomes (BACs). So he did a stint in the lab of BAC guru Pieter de Jong, then at Roswell Park Cancer Institute in Buffalo, New York. To begin, de Jong asked Yerkes for a sample of chimp sperm, and researchers there chose Clint—not because he was a hardy male representative of *Pan troglodytes* or had some other meaningful attribute. Clint, it turns out, became the genome chimp because he was particularly fond of providing sperm samples.

Eichler did not make much progress, but after he left the lab, de Jong, now with Children's Hospital Oakland Research Institute in California, decided to continue trying with samples of Clint's blood instead of sperm. His lab eventually succeeded, and they stored the clones in a freezer. When Eichler and a small group of colleagues in 2002 decided to sequence the entire chimpanzee genome, they fished out Clint's DNA.

In 2004, the year before the first draft of the chimpanzee genome was published, Clint, then 24, died from heart failure. But his sequence lives on in databases that Eichler, now at the University of Washington, Seattle, and scores of other researchers continue to mine for surprising insights about chimpanzees and how they relate to humans and other species. "Science never goes a straight path," says de Jong

– J.C.