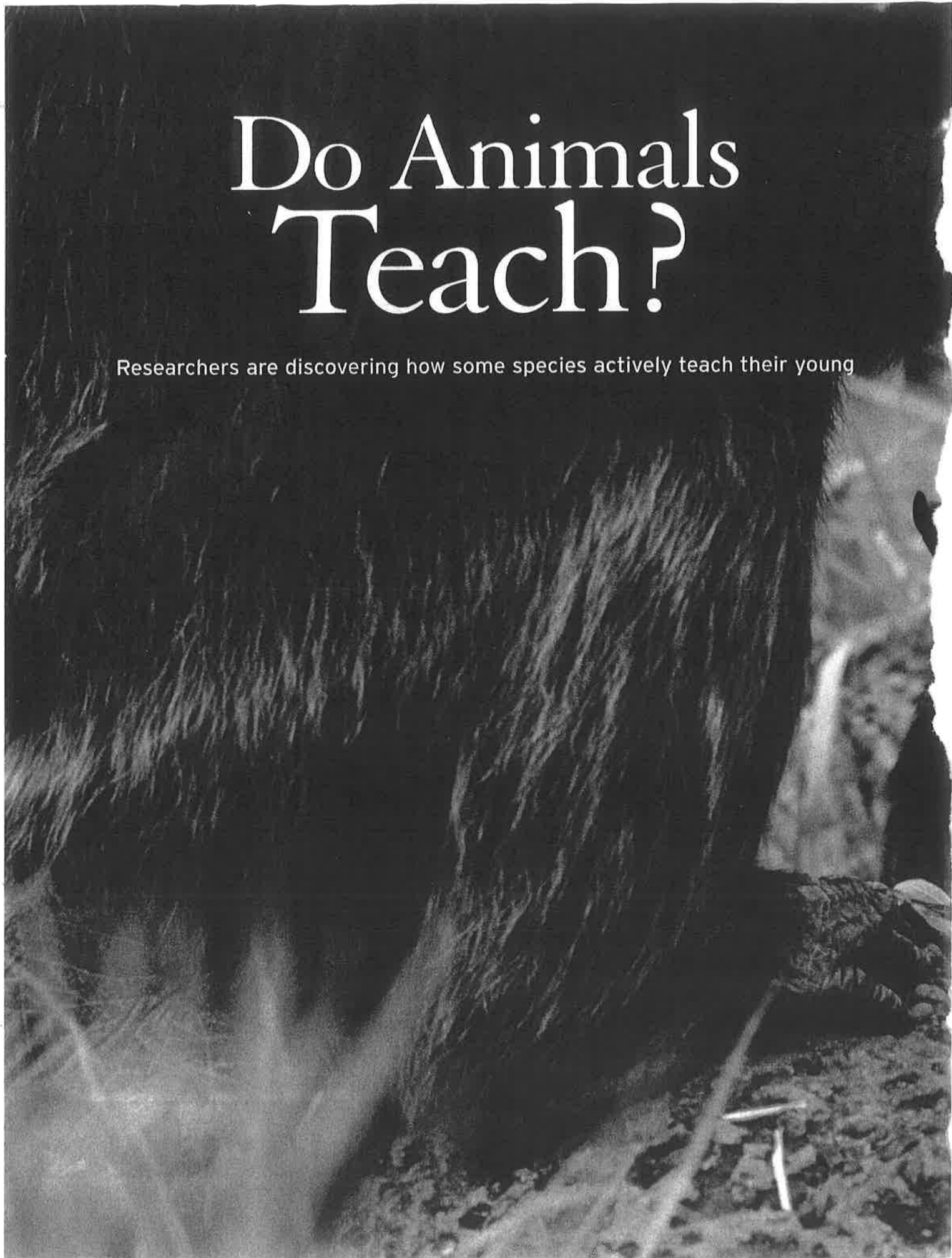


Do Animals Teach?

Researchers are discovering how some species actively teach their young



BY VIRGINIA MORELL

While watching a mother golden lion tamarin in Brazil 15 years ago, primatologist Lisa Rapaport spotted something she's never forgotten. The small, ginger-furred monkey had reached her long-fingered hand deep inside a broken tree branch, searching for food, perhaps a fat beetle or spider. But instead of pulling out dinner, the mother called to her 7-month-old infant, making a soft, chattering cry. Scientists describe that sound as the "food-transfer call" because parents utter it just before handing prey they've captured to their offspring. In this case, though, the mother didn't give her child anything. Instead, she moved aside

and let her youngster reach into the hollowed branch. "He pulled out a frog," Rapaport says. "I couldn't believe it. It was like a lesson to show him—to teach him—where to look for prey."

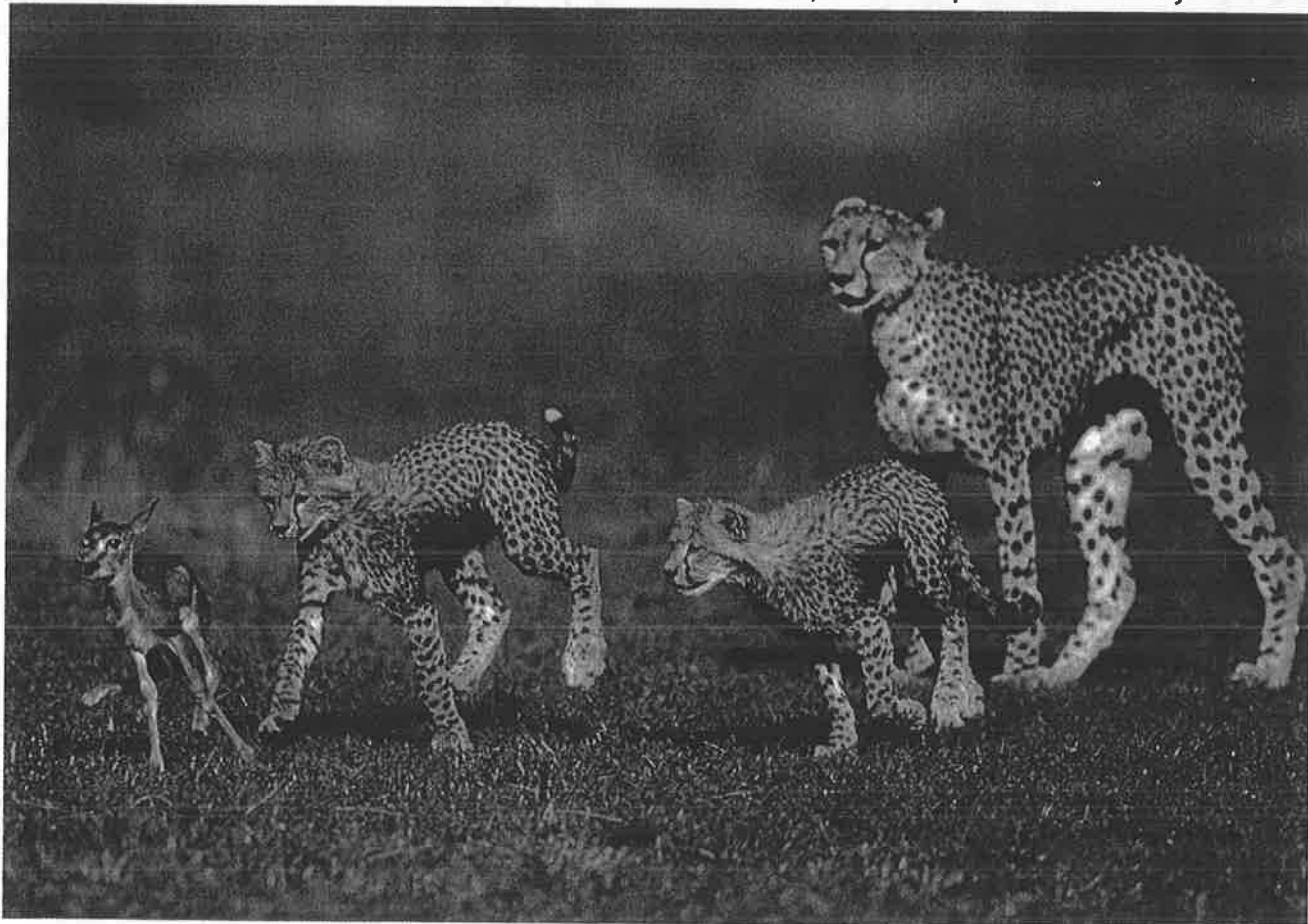
Rapaport's surprise stemmed from a lesson she'd been taught that reflected conventional wisdom: Animals don't engage in pedagogy. "People had looked for teaching in other animals, especially in nonhuman primates like chimpanzees," she says. "But they'd never found a good case for it and were skeptical that any animal could teach."

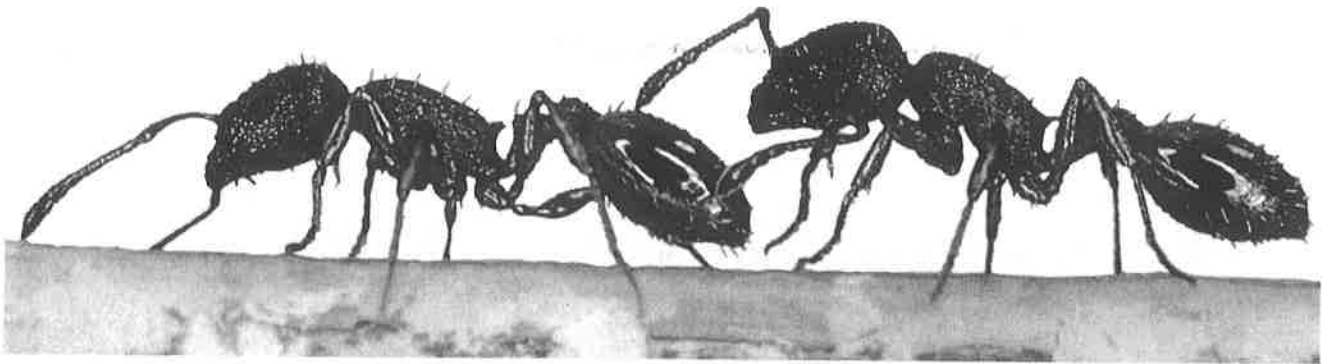
Recent studies are proving the skeptics wrong. Just since 2006, animal behaviorists have found strong

evidence of teaching in four species (other than humans): meerkats (*Suricata suricatta*), southern pied-babblers (*Turdoides bicolor*), superb fairy-wrens (*Malurus cyaneus*) and a species of rock ant (*Temnothorax albipennis*). Researchers suspect that many more species—from orcas and elephants to chickens and bees—will also be recognized as teachers. "It's a young field, so teaching ought to be studied rigorously," says Alex Thornton, a behavioral ecologist at the University of Exeter in the United Kingdom. "It's almost surely more widespread than what we know. But we also need the evidence."

Why is that evidence so scarce? Largely because of debates over the

Nature takes its course in Kenya as cheetah cubs learn how to hunt a young Thomson's gazelle. A mother will catch young prey and release it for her cubs to chase, repeating the process often at her own expense—one key indicator of teaching.





Leading the way to food, a rock ant—the first nonhuman species shown to teach—emits a pheromone to entice a follower then leads a “tandem run” (above), pausing while the follower memorizes landmarks and moving only after receiving a tap on her hindquarters.

definition of teaching. For most of the 20th century, psychologists saw teaching as something that required sophisticated cognitive abilities such as foresight and intention. In other words, the teacher had to intend to give a lesson—something extremely difficult to determine in animals other than humans.

“The psychologists set a very high bar that effectively kept other animals out,” says Tim Caro, a wildlife biologist at the University of California (UC)–Davis. Some researchers have gone so far as to suggest that traditional classroom school teachers in Western societies are the model for what a tutor—human or other animal—should be. And some anthropologists have argued that teaching only takes place in a classroom and question whether people in hunting-gathering societies taught.

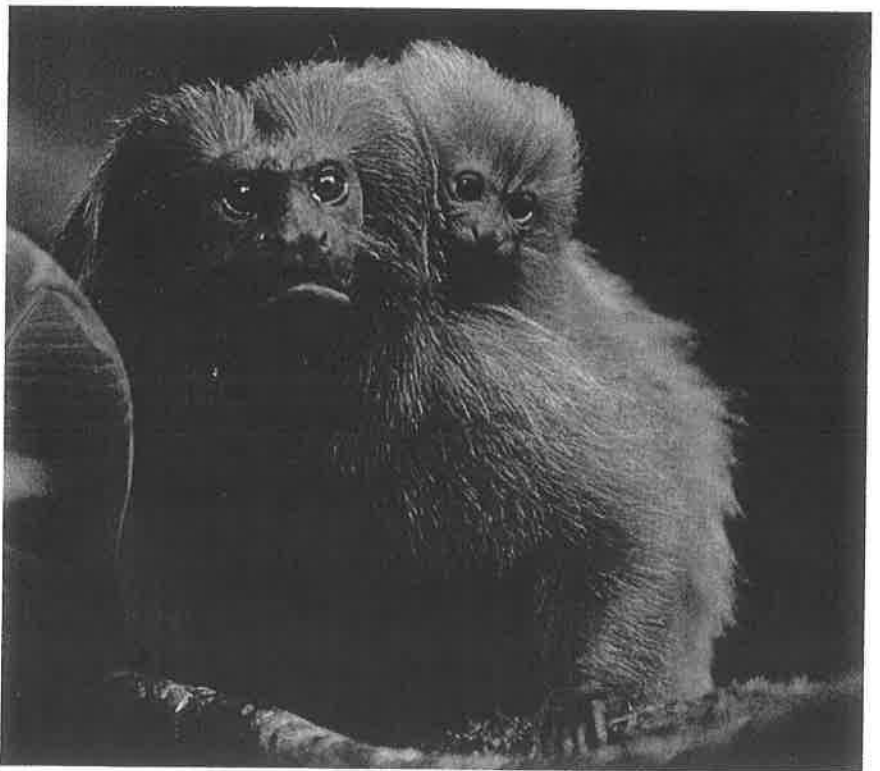
A Shift in Thinking

That notion was only recently overturned, largely because of the new studies showing teaching in animals. Scientists now recognize teaching as a behavior that evolved—that is, it has a biological past, one shaped by natural selection.

The definition of what constitutes teaching in animals has also evolved. Back in 1992, Caro and Marc Hauser, then a colleague at UC–Davis, proposed a new definition of teaching that avoided the problem

of trying to determine an animal’s intention. Instead, they said wildlife scientists could identify teaching through careful observation of three key elements: a change in the teacher’s behavior in the presence of an inexperienced student, a cost to the teacher and evidence that the formerly naive pupil gains knowledge or skills—through encouragement, punishment or by example—more rapidly or earlier in life than if the student were on his or her own.

Caro began to develop this definition while studying cheetahs in Tanzania’s Serengeti National Park. During two decades of fieldwork there, he watched as cheetah mothers schooled their cubs in what to eat and how to catch and kill it. When her cubs are about 10 weeks old, a cheetah mom first introduces them to solid food by calling them to the carcass of an animal—usually a gazelle—she’s just killed. She increasingly lets the kids join her



A golden lion tamarin mom may give her baby more than a lift: The primates appear to teach by calling their young to food and letting them retrieve it.



Superb fairywrens in Australia prepare to share a meal. This is one of only four species of animal that studies have shown actively teach their young. In fairywrens, a mother teaches her unborn chicks a special call or “password” they use to beg for food after hatching. This ensures the chicks get more food than do brood parasites, hatchlings of other species that invade the nest.

when she’s hunting, although Caro says they do little more than play and disrupt her work. And then she catches a newborn gazelle and doesn’t kill it. Instead, she releases it in front of her cubs. “The neonate gazelle can’t run fast, and the cubs swat at it, and try to knock it off balance. It gets up and runs. And the cubs knock it down again. After about 10 minutes of this, the mother cheetah comes back in and strangles it.” Later, she will bring the cubs an adult to tackle—but because they are so inept, they often lose this prey.

A cheetah mother clearly changes her normal predation behavior when hunting with her cubs. And she is surely hungry after she’s hunted for a gazelle and brought it back only to watch as her inept cubs let dinner run away—a cost to the mother. Ironically, however, Caro wasn’t willing to recognize cheetah moms

as teachers, according to his definition, because he could not prove that their cubs’ hunting skills improved following the practice sessions on live prey. Nonetheless, cheetah mothers “show many of the hallmarks of being good teachers,” he says.

First “Proven” Teacher

Though most scientists embraced Caro and Hauser’s three-part definition of teaching, more than 20 years passed before anyone was able to show that an animal qualified as a tutor. The first that measured up was a controversial surprise: a rock ant.

In early 2006, Nigel Franks, a behavioral ecologist at Bristol University in the United Kingdom, and his then graduate student, Tom Richardson, published a study in the journal *Nature* that was the first to show teaching in a nonhuman species. Through carefully controlled

experiments, the researchers found that tiny, hyphen-sized rock ants fulfilled all of the criteria that define animal teaching. Unlike most other ant species, rock ants don’t rely on a chemical trail to find their way. Instead, like someone new to Manhattan and lacking a map, they memorize vertical landmarks. So, for instance, when a scout rock ant finds a new bit of food, she returns to get others to help her bring the bounty home—showing the new route to only one ant at a time.

First, she changes her behavior by releasing a pheromone that tells another ant to follow her. The two travel a “tandem run,” with the scout moving forward, then waiting as her pupil memorizes the landmarks. With a tap of her antennae to her teacher’s hind quarters, the student tells the scout she’s ready to move on to the next lesson, that is,

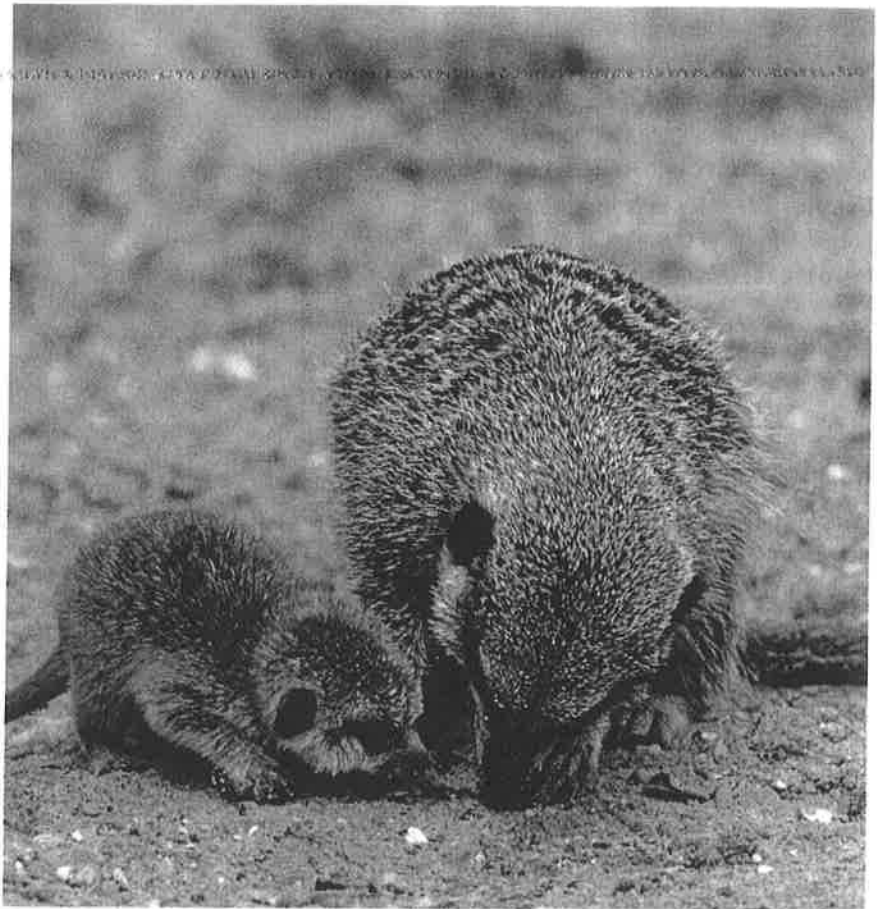
In southern Africa, a meerkat mother and baby (captives, right) dig for food—a risky chore. Meerkats eat scorpions (bottom), whose stingers can harm young pups. Older meerkats teach younger ones how to disable prey, making lessons more difficult as pups age.

the next part of the route. To Franks and Richardson, that slow, start-stop journey was the “cost” to the teacher because she could have traveled faster without her student, and waiting left her vulnerable to predation or another mishap. The student clearly gained important knowledge: the location of food. And the student could now become a teacher, too, guiding another ant to the prize.

There was just one problem with the study: It involved ants. “A lot of people were affronted by the idea of ants teaching,” Thornton says, so the critics “moved the goal posts” by adding a new element to the Caro and Hauser definition. They claimed the teacher also had to know the student’s level of knowledge, something that would be exceedingly difficult for researchers to assess. Franks and Richardson responded by publishing another study in *Current Biology* showing that the ant teachers did evaluate their students’ knowledge because the teachers waited for their pupil’s tap before moving ahead.

Why Teaching Evolved

While some psychologists continued to grumble about ants as teachers, many evolutionary biologists were thrilled by the paired breakthrough studies. Finally, scientists had figured out an experimental way to test for teaching. “People want to cling to the notion that people are unique,” says Thornton. “But teaching isn’t necessarily cognitively complex. Consider “motherese”—the way mothers across all human cultures talk to their infants. It doesn’t require an awareness of the child’s inner state.



Orcas rocket toward shore to attack sea lions on the Valdes Peninsula in Patagonia, Argentina. This dangerous hunting technique can leave the whales beached, yet they've been observed letting youngsters try to learn the skill, a potential form of teaching. If offspring learn the technique, it benefits the pod.

But from an evolutionary point of view, it is a form of teaching.”

To Thornton and other scientists who view teaching through an evolutionary lens, teaching is a type of cooperative behavior, like hunting or sharing food. If you think about teaching this way, these researchers say, then you'll be less concerned about the psychological mechanisms that underlie pedagogy (which will be difficult if not impossible to identify in other animals). Instead, you'll want to understand the evolutionary pressures that led to teaching.

“Teaching is a way of transmitting information by social learning,” Thornton says. “But as every teacher knows, it does involve costs—and it can be years before the teacher benefits. So why would natural selection favor a behavior that makes me go out of my way to help you?”

Lesson One: Survival

Thornton and his colleague, Katherine McAuliffe, answered this question for wild meerkats of southern Africa, publishing their results in *Science* in 2006, a mere six months after the rock ant study.

Meerkats are cooperative breeders that live in groups of two to 40 individuals in an arid and challenging environment. Males and females of more than 3 months old help raise the infants, giving them food—often scorpions. But this is a dangerous, toxic prey, so the helpers kill or disable a scorpion before giving it to a pup. As pups mature, helpers hand them more intact prey. Eventually, with practice and supervision, pups



learn how to pull out the scorpion's stinger on their own.

At first glance, it appears that the helper-tutors are making some assessment of what young pups know and don't know. But tutors are not using such “sophisticated cognition,” says Thornton. Instead, “the pups make different begging calls as they age, and those sounds trigger the helper's behavior.”

He and McAuliffe discovered this via an experiment that involved playing recordings of the pups' calls to foraging groups. When the scientists played begging calls of older pups to foraging groups with younger pups, the tutors were fooled and brought intact (more dangerous) prey to the

young, inexperienced pups. Likewise, when the cries of younger pups were played to groups with older pups, the tutors brought more disabled (safer) prey—in each case exactly the opposite of what they should have done. Thus, the helpers weren't deciding what to feed the pups based on the youngsters' capabilities; rather, the tutors were simply responding to the pups' cries.

Taking the time to hunt and disable prey is costly, and, like cheetah mothers, meerkat helpers often watch as pups fumble with and lose their meals. So why do they teach? Because, Thornton says, the faster the pups learn how to handle prey, the sooner they'll become helpers.



“Teaching promotes the acquisition of a behavior that’s difficult to learn on one’s own and that’s critical for survival,” he says. “And it benefits both the teacher and the student.”

ABCs for Birds

In pied-babblers, an avian species that lives in groups in the Kalahari Desert, adults teach nestlings to associate a “purr” call with food by emitting the call every time they come to feed the chicks. Again, the teaching method isn’t sophisticated; it’s simply stimulus-response conditioning, much like clicker-training a dog. But the benefits to the teachers are impressive because the calls ultimately help ensure the offspring’s

(and thus the adult’s genetic) survival.

Using playback experiments, scientists studying the birds showed that while the nestlings merely beg in response to purr calls, the fledglings actively approach the calling adults (who endure energetic costs for their teaching efforts). The adults can then use these same calls to move the youngsters away from dangerous predators or to places to forage.

With further study and experiments, animals that are strong candidates for animal teachers, such as Rapaport’s tamarins, will undoubtedly be added to today’s short list of bona fide animal teachers. Yet even with the limited number of proved teachers, Thornton, Caro and Ra-

paport agree the young field is off to a great start. “It was moribund for a long time,” Thornton says. “But now that we’ve found teaching in distantly related species—meerkats, ants, birds—we know it is not a unique human ability.”

Rather, the diversity of animal teachers tells us that this skill has evolved independently many times. Perhaps this is because it is the best way to pass along vital knowledge and information, things that are so important a teacher—even an animal teacher—is required. ♦

Science writer Virginia Morell is the author of Animal Wise: How We Know Animals Think and Feel.

Name: _____ Date: _____ Block: _____

***Do Animals Teach?* by Virginia Morell (National Wildlife, October/November 2015)**

I. Define

Step 1: Find each word in the article and circle or highlight it.

Step 2: Read the sentence in which the word is used.

Step 3: Look up the word's definition and choose the one that best matches the way the word is used in its sentence. Write that one down.

utter	naïve	arid
pedagogy	pheromone	acquisition
cognitive	affronted	stimulus

II. Comprehend

1. What are the three elements scientists used to identify instances of teaching?
2. Why didn't scientists recognize cheetah mothers as teachers?
3. "So why would natural selection favor a behavior that makes me go out of my way to help you?" (p. 28) Give an answer to this question using either the meerkat or pied-babblers studies.

III. Extend

The article mentioned, many times, that teaching comes at a cost to the teacher. Apply this idea to human parents, who are their children's first teachers. What costs do they incur? Give at least three concrete examples.