

# ANIMAL BEHAVIOR

Animal  
**Life in Groups**

TONEY ALLMAN



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CHRISTINA WILSDON

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Animal Communication

Animal Courtship

Animal Defenses

Animal Hunting and Feeding

Animal Life in Groups

Animal Migration

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**CHELSEA HOUSE**  
P U B L I S H E R S

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**Cover:** A herd of African elephants cross a river together.

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# 1

## Living Together

**A MEERKAT ALONE** is a pitiful thing. Its situation is unnatural. It hunkers down, hiding, seemingly terrified. All it can do is try to make the treacherous journey across the southern African desert plains of its territory, back to its home burrow and its family. Without a family group, a meerkat has little chance of survival. Perhaps the meerkat instinctively knows this. Throughout its life, it is a member of a **society**. It depends on this social community to stay alive.

Many kinds of animals, including humans, live all or most of their lives in societies. These social communities are groups of individuals that communicate and cooperate with one another for the benefit of the group. Animals that happen to meet while hunting, **foraging**, or drinking are not social groups. Neither are animals that mate and then go their separate ways. A mother raising her young does not make up a social group either, especially if the young eventually leave her. A society of animals is a true organization of animals that depend on one another and develop bonds with each other that keep them together.

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Meerkats stay close and work as a team in order to survive in the wild. They help one another in all aspects of daily life, including searching for food and staying away from predators.

### JUST ONE OF THE GANG

Meerkats are social animals. They are a type of mongoose, but most members of the mongoose family live alone. Meerkats live in community groups, called mobs or gangs. A meerkat mob may have between 2 and 40 members, but small mobs are likely to grow quickly. A male and female pair of meerkats starts each mob. They are the **alpha** meerkats: the leaders of the gang.

When the alpha female gives birth to a litter, the babies, or pups, grow up and remain with their parents. The family lives together in underground burrows. Over time, the burrows grow

into a complex system of sleeping rooms, tunnels, mounds, and entrance holes. Several burrows are scattered around the gang's home territory. Together, the meerkat gang works on burrow construction, sleeps, hides from **predators**, defends their territory, and goes off to find food. When the alpha pair has more pups, the family cooperates in rearing and caring for them. "Curious, playful, and mischievous meerkats survive the threats of the wild while working as a family and a team," said wildlife expert and Animal Planet special advisor Peter Gros in an Animal Planet Web chat.

## GANG LIFE

Every sunny morning, the meerkat mob leaves the burrow and goes searching for food. If there are pups in the burrow, one meerkat stays behind as the babysitter. The babysitter may be male or female and is an adolescent or young adult. Scientists do not really know how the babysitter is chosen, but they think that the meerkat who is the least hungry stays behind. At the end of the day, other meerkats will bring food back to the babysitter.

Throughout the day, the meerkat mob forages for food together between rest periods. One alpha meerkat is **dominant**. This meerkat makes decisions about when and where to go, and the other group members follow its lead. Even in feeding activity, there is cooperation. The meerkats take turns being sentries while the rest of the group dig for insects, worms, mice, little snakes, fruit, ant larvae, scorpions, and other tasty food. Sentries stand straight up on their hind legs and scan for threats from predators. Quite a few animals hunt meerkats. They include eagles, hawks, jackals, large snakes, wild cats, and badgers.

If no predators are around, the sentry makes continual chirruping sounds. Feeding meerkats make these sounds, too, as they move around digging for meals. These sounds mean that all is

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A meerkat in the Kalahari Desert in South Africa actively watches for predators. If it sees approaching predators, it will call out a warning to others in its group so they can run and hide, and then it will follow them.

well. If the sentry sees a predator, he or she gives an alarm call that warns the other meerkats of danger. If the predator is a dangerous snake, the gang may engage in **mobbing** behavior. They harass and bother the snake until it crawls away. They may even kill the snake with repeated attacks and bites. One meerkat could never fight a snake on its own, but a gang is usually successful. If the predator is a hawk or an eagle, the gang runs to the nearest burrow or den. They may not sleep in these dens every night, but meerkats remember the location of every burrow. The gang rarely forages for food unless a burrow is nearby. A meerkat gang

defends its burrow system against other meerkat gangs that may try to take over the territory and food supplies. Every meerkat recognizes the members of its own gang. They know who belongs and who is a stranger.

## **RAISING A LITTLE MOB MEMBER**

Young meerkats are protected and taught by the adults. The young learn survival techniques from the older meerkats and stay safe until they grow up.

When young meerkats are about four weeks old, they are allowed to leave the burrow. Then, other meerkats teach them how to find food. Pups are taught what is edible and how to dig for food. They also are taught how to make a scorpion safe to eat. (Pull off the poisonous tail, avoid the strong pincers, and kill the scorpion quickly before swallowing it.) Pups also must be taught to run when they hear an alarm call, and they must know how to find the nearest burrow. If a pup ventures too far from the gang while looking for food, it gives a loud “lost” call. Then an adult, often the pup’s mentor, gets it and leads it back to the gang.

When pups see adults with food, they produce begging calls. Often, the adult will share its food. When a pup is first learning to find meals outside the burrow, adults give it killed food. When a pup is older, adults bring it live food (such as an insect) and let the pup kill its own food. If the insect runs away, an adult will nudge the moving meal back to the pup so it can try again.

## **GANG BONDS**

Meerkat gangs work together to ensure that pups grow to adulthood and that the gang survives, but meerkat group life is not all work. Gros has said the group is playful, too. Meerkats seem

## **MEERKAT AGGRESSION**

**The social actions of meerkats are not always cooperative. Sometimes meerkats are aggressive—hostile and destructive—to other group members. For example, the alpha female will often attack other female adults who have “broken the rules.” If these females mate and get pregnant, the alpha female may attack them and force them out of the group. If they give birth in the burrow, the alpha female may kill the newborn babies.**

**Killing newborns is not unusual in animal groups. Scientists say that the alpha meerkat kills other newborns to help improve the chances that her babies survive. There may not be enough food to feed all of those youngsters, so the alpha female protects her young first.**

**In some other kinds of animal groups, a male sometimes kills infants after he defeats a group’s old alpha male. As the new alpha male, he wants to mate with the females and produce his own offspring. He kills the infants so that the females will be willing to mate again.**

to really enjoy one another’s company, and they spend a lot of time just playing. Adults and pups will wrestle and play-fight for fun. They chase each other or play “keep away” with a leaf or stick.

Meerkats also spend a lot of time **grooming** one another. One meerkat will comb through, lick, pick, and scratch the skin and fur of another. Fur is smoothed; dirt is removed; parasites, such as ticks, are picked off; and both animals become relaxed and calm. Scientists believe grooming not only helps animals stay clean, but also helps maintain social bonds within the group. Certainly, meerkats seem to love being groomed and to enjoy grooming others.



Meerkat families spend a good deal of time grooming each other and playfully wrestling.

Despite their close, seemingly affectionate ties, meerkat gangs do not stay together for life. Adult meerkats often wander away to find other gangs or start their own gangs. This is because the alpha pair usually will not allow other animals to breed and have pups. Adult meerkats who want to mate must leave the group. At the age of three or four, many adult meerkats risk traveling alone to find a mate or another gang that needs new members. (Perhaps, for instance, an alpha female has died in a neighboring gang.) This search for a new group helps keep the gang healthy. It ensures that brothers and sisters or parents and offspring do not mate together. When close relatives mate and breed, the chance of birth defects increases.

## A GROUP FOR A LIFETIME

A meerkat gang—with its alpha pair, cooperative behaviors, group care of pups, and wanderings to other gangs—is a very successful kind of society, but it is not the only way that animal groups organize themselves. Animals can live in several different kinds of social groups. Some may not be led by alpha pairs. Others may not use grooming to strengthen social bonds. Still others may have many breeding females in the group at one time. And some have members that live with the group their entire lives.

Elephant groups, for instance, are social and cooperative, but elephant society is run by females. Females drive adult males out



In the matriarchal society of elephants, the oldest and most experienced female leads the way. Here, an African elephant matriarch takes the lead in its herd.

of their groups. A matriarch, the oldest and most experienced elephant, leads the herd. Related female elephants and their young make up the rest of the herd. The matriarch knows where to find water during a drought, and when foods are ripe in each part of the territory. The other elephants learn from her and follow her direction.

The group may consist of a matriarch, her sisters, her grown daughters and granddaughters, and any other offspring of these females. The young elephants, called calves, may be newborn, **juveniles**, or adolescents up to about 14 years old. After that age, males are driven out. The females remain with the group for their whole lives. Elephants live about as long as humans do, so females live with the same group for decades.

Male elephants are not unsocial. They may follow behind their family group for years, join up with other bull elephants in friendship pairs, or form small, all-male groups of their own. They will usually be friendly to any female family they meet, but they do not stay with any group. Usually an older bull joins a group temporarily, just for mating.

Unlike males, female and immature elephants are tightly bonded to and dependent on their social groups, and their society is well organized. Each herd consists of about 10 closely related elephants led by a matriarch. Several family units live in one home territory. These families know one another and are called a kinship group. They are all related to each other in some way—as cousins, sisters, grandnieces, and so forth. When the kinship group is together, one elephant is the dominant matriarch. The other matriarchs defer to her. She can take over a prime feeding spot or water source. She decides whether danger threatens and what to do about it. The other elephants follow her lead. A kinship group can be as large as 150 elephants, all getting along well and seeming to be affectionate toward one another.

## **LONG-DISTANCE GROUP COMMUNICATION**

**Elephants can make sounds that people cannot hear. These sounds are deep, low rumbles—too low for human ears, but easily heard by other elephants. Elephants can also feel these low sounds with their feet as they vibrate through the earth. With these sounds, elephants are able to communicate with one another and with other groups that are as far as 20 miles (32 kilometers) away. A herd knows that other herds are coming by feeling their sounds. They can feel the vibrations of danger calls from herds far in the distance. Bull elephants may be able to find females ready to mate by following their rumbles. This communication ability may even help elephant herds find water. Scientists say it is possible that elephants pick up the vibrations of thunder from far away. If they feel the thunder, they know it is raining in the distance and move toward the sounds.**

## **ELEPHANT SOCIAL BEHAVIOR**

Elephants do not groom one another, but they touch and caress frequently. They greet one another with trunk-to-mouth touching. They pet one another with their trunks and lean against one another. Young elephants play together and climb on resting adults. Especially during a calf's first year, the older elephants are tolerant of its play and are helpful and protective toward it. Often, an older juvenile or young adult will become an "auntie" to a newborn elephant. She will wait for it if it lags behind the group, let it hide under her belly for comfort and protection, and pick it up with her trunk if it falls. Sometimes, an older female will even allow a calf to nurse from her. Everyone in the family may respond when a baby elephant gives an alarm call.

Elephant expert Iain Douglas-Hamilton describes a lifesaving auntie in his 1975 book, *Among the Elephants*. A baby male elephant had been running around playing when he fell into a deep bog. He struggled to get out and then gave a “terrified squeal.” According to Douglas-Hamilton, both the mother (whom he had named Lenora) and his auntie, Slender Tusks, immediately responded with concern. “Slender Tusks gingerly waded out, her feet [plowing black syrupy ruts in the mud],” Hamilton wrote. “Fortunately she found firm ground under the surface layer. First she tried pulling him with her trunk, but when this failed, she moved around him and placed her tusks under his belly and shoved. Leonora stood watching, not yet committing herself to action. With [the baby] struggling and Slender Tusks pushing with all her might he gradually floundered back to firm ground. . . .”

As with meerkats, living in a social group helps ensure that baby elephants will survive. Aunties may also gain valuable child-care experience so that they will be good mothers when they have calves of their own. Elephant families protect their babies from predators, too. No predator (except hunting humans) can endanger a grown elephant, but some predators, such as lions, may threaten very young calves. In the face of such a danger, the matriarch sounds the alarm, and the elephants group together tightly. They face outward and pull the calves into the center of the circle. This way, the predator has no chance of attacking any calf.

## THRIVING GROUPS MEAN SURVIVAL

Elephant family groups and kinship groups are a survival strategy for members, just as mobs are for meerkats. Apparently, all the members benefit from and need the relationships that they develop within the groups. They learn from one another,

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cooperate with one another, and, according to observers, seem to love one another. “For elephants, the unity of the family is one of the most important things in their lives,” Douglas-Hamilton explains in *Among the Elephants*. But animal scientists wonder why this should be the case. Slender Tusks risked her own life to save the baby stuck in the mud. Meerkats that give their food to pups will have less food for themselves. Living in a group means having to be unselfish at times. It may mean fighting with other members and risking injury, or giving the leader the first drink of the scarce water supply. It seems odd that some animals would risk their own lives in these ways in order to help others survive.

Meerkats and elephants represent just two kinds of groups, but many other animals—from insects to horses to monkeys—organize themselves into social groups, too. Individuals in these groups experience both advantages and disadvantages, so scientists wonder how the advantages come to outweigh the disadvantages. They ask how and why animals formed social groups in the first place. They try to learn how social groups are different from one another and what kinds of survival strategies work for different groups. These are the basic questions that scientists face as they learn about group behavior in animals.

# 2

## Groups for Survival

**ROBERT SAPOLSKY WAS** far from being an animal expert. In 1978, he was 21 years old, with a recent college degree and a dream of going to Africa to study animals. A professor gave him the opportunity to go to Kenya and observe a troop of baboons. Sapolsky later remarked that 1978 was the year he joined a baboon troop and learned to think like a baboon himself. For the next 20 years, he spent part or most of each year with the group of baboons he came to love. Along the way, he earned his doctorate, became a baboon behavior expert, and helped the scientific community learn about animal life in groups.

The first weeks of Sapolsky's observation project were devoted to habituating the animals to his presence. This meant getting the troop used to him. He approached the troop closer and closer as the days passed, being careful not to frighten or interfere with them in any way. His goal was to become as unimportant as part of the landscape, or at least as ordinary as any other member of the troop. The next stage involved learning to recognize each of the 63 animals in his troop. With some animals, he noticed differences in hair color. He recognized others by crooks in their tails. One had a big, bulbous nose, and some had scars from old wounds. Eventually,

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Robert Sapolsky's baboon observations showed scientists new ways to look at animal life in groups. Here, Sapolsky poses with a baboon in Nairobi, Kenya in 1990.

Sapolsky could tell all of the baboons apart, and he gave each one a name. Then he was ready to keep detailed notes and records of their daily behavior. He could learn who interacted

with whom, which individuals were dominant, and how baboon society functioned.

## WILD OBSERVATIONS

The contributions of people like Sapolsky are one reason that scientists now know about many different kinds of animal groups, how they are organized, and how the groups survive. Often these observers were not trained. Yet, they became experts. They taught the scientific world a new way to learn about animal lives. The animals were not subjected to experiments, tested in laboratories, or observed in zoos, as they had been in the past. Instead, the observers learned about groups living their natural, richly complex lives in normal, wild environments.

One of the first of these observers was Jane Goodall, who studied chimpanzees in Africa during the 1960s. She was young, relatively uneducated, and knew nothing about surviving in a tent in the wilderness. Her mother came with her on her first trip to help protect and care for her. Yet, Goodall survived and thrived in the wild environment and became a primatologist, an educated expert in the behavior of primates. Her discoveries about chimpanzee communities make her one of the most respected animal scientists in the world today.

Becoming such an observer and expert is fraught with difficulties and takes years of patient observation. Sapolsky lived in a tent on the African savannah and coped with bugs in his food, fungus growth on his feet, and fevers that came on without warning. Beginning in the late 1960s, Dian Fossey lived in the isolated mountains of Rwanda to study gorillas. She was murdered there in 1985, but the crime was never solved. Fossey's book, *Gorillas in the Mist* (later made into a movie, with actress Sigourney Weaver as Fossey), is considered a classic in the field of animal behavior.

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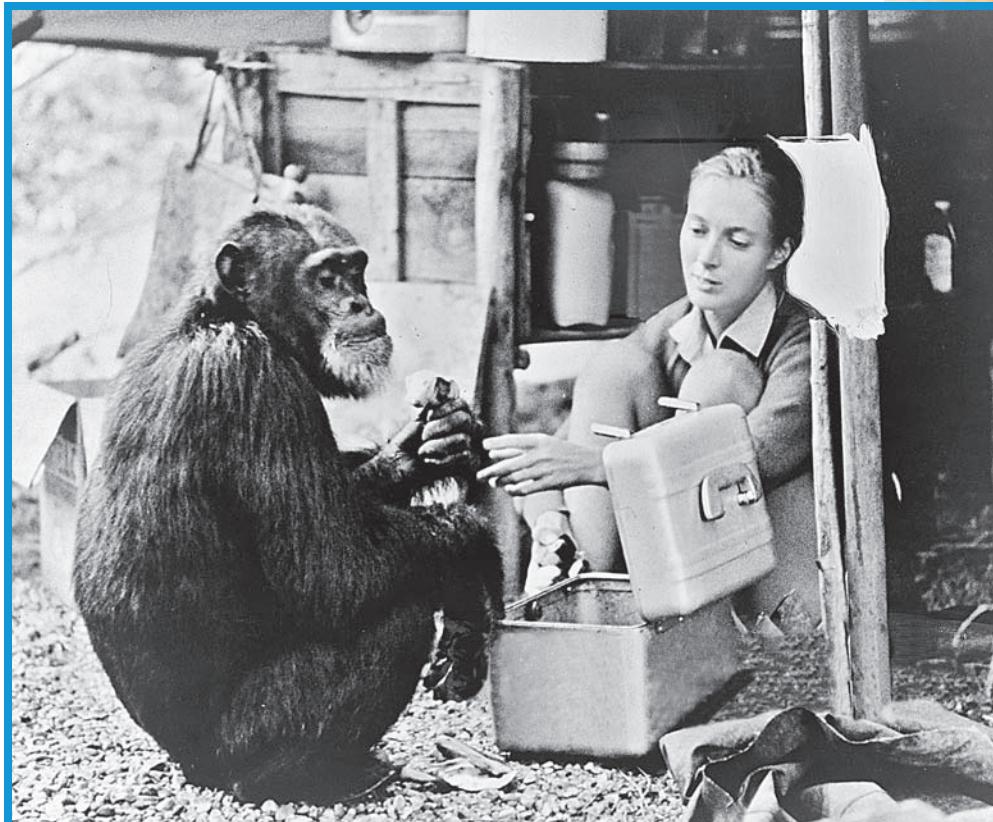
Shirley Strum observed baboons, as Sapolsky did. She had to learn to squint against the burning African sun because the baboons were frightened if she protected her eyes with sunglasses. Rachel Smolker traveled deep into the Australian outback to reach an ocean cove where dolphin societies could be observed. She had to hitchhike the last few hundred miles to her destination and live in a tent on a beach. Iain Douglas-Hamilton observed African elephants, alone and cut off from human society for most of each year. He endured parasite infections, destructive charges to his car by angry elephants, and a goring by a rhinoceros.

### **RULES OF OBSERVATION**

Studying animals in the wild can be hard, sometimes dangerous work. But it's also the best way to learn more about group living. By identifying each animal, researchers can learn about kinship groups, alpha animals, and differences among animals in

#### **AN OBSERVER IS ATTACKED**

**Researcher Bill Weber was on his hands and knees, crawling through a tunnel of vegetation. He was trying to follow the trail of a gorilla family that had run away when a member of Weber's observation group had made too much noise. Suddenly, Weber looked up and saw a big male gorilla staring back at him. This gorilla was a stranger to him. It was not used to having humans watch it. The gorilla charged, and Weber could not escape. He was bitten on the neck, knocked unconscious, and then dragged through the brush. Two of his ribs were broken. Weber did not blame the gorilla for his injuries. He blamed himself. He knew that his startling appearance on the trail had stressed the gorilla so much that it felt forced to attack.**



Jane Goodall reaches out to David Greybeard, the chimpanzee who showed her that chimps are not vegetarians.

the same group. Watching the same animals over a long period of time helps confirm that the observer's conclusions are accurate. Researchers learn details about each social group and how it may help the individuals to survive. It was Jane Goodall who discovered that chimps eat meat. Until she saw a male named David Greybeard eat a bush pig, scientists thought chimpanzees were vegetarians. Years after her research began, she discovered that chimps engage in war. She watched one community of male chimps seek out and attack a neighboring community. Only her

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long period of observation revealed that chimps were not as gentle and peaceful as she had originally believed.

Goodall came to love the chimpanzees she studied. All long-term observers seem to become emotionally bonded with their subjects. Yet, researchers can't let their feelings affect their science. They cannot interact too much with the animals, or else they might change natural behavior. They cannot assume they know what an animal is feeling or thinking in a certain situation, just because a human might feel that way. That is called anthropomorphism. For example, researchers can't assume that if one animal takes away another's food, the second animal is "angry" or "jealous."

No matter how emotionally attached they are, observers must only take notes on animals' behaviors and be careful about drawing conclusions about what the behaviors mean. Some scientists are not sure that animals have emotions at all. Through years of observation, however, observers such as Goodall, Douglas-Hamilton, and Sapolsky came to realize that the animals they studied were actually more like humans than scientists ever realized. The scientific community also came to accept these conclusions. Ethology (the study of animal behavior), primatology, sociobiology (the study of how behavior evolves), and zoology are just some of the scientific areas of animal specialty. Experts in these sciences have learned that many animals, like people, have feelings, thoughts, and affection for one another. Positive feelings, such as affection and attachment, probably keep individuals bonded to the group.

## **ADVANTAGES OF GROUP LIVING**

Staying a part of, and bonded to, a group is important for many kinds of animals. Experts in animal behavior think that living in a group helps these animals survive better than if they lived

alone or in pairs. Scientists assume that every animal's behavior increases its chances of survival. So group living must increase the chances of survival for the individuals in the group; otherwise, they wouldn't live in a group. Ethologists and other animal scientists have identified several advantages to living in groups.

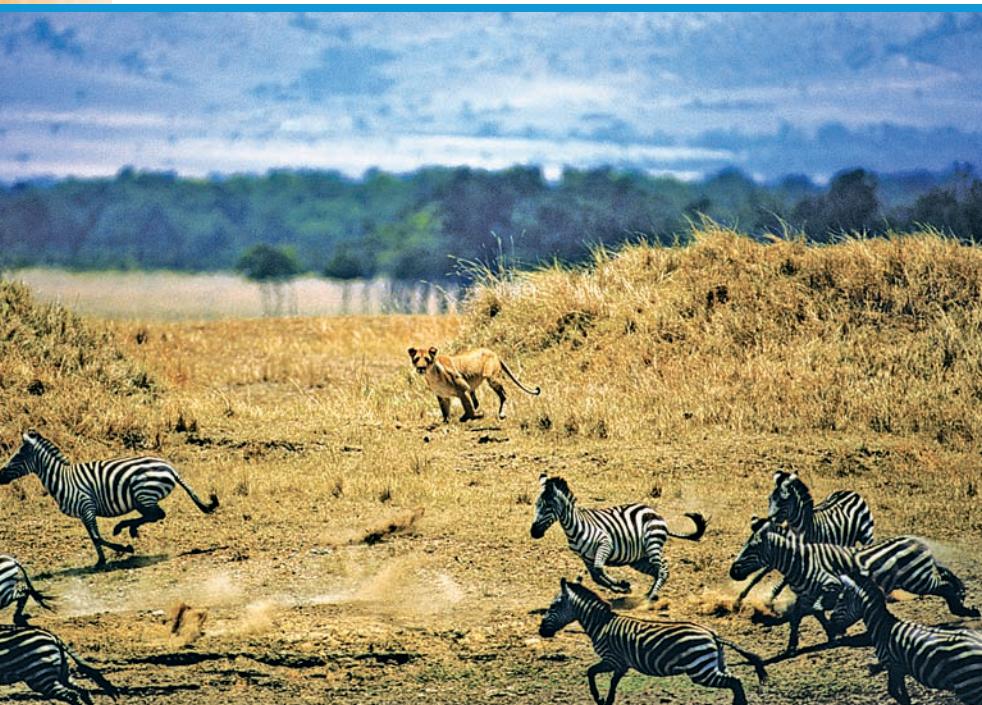
Protection from predators is probably the biggest advantage. One theory about how this protection works is called the **Many Eyes** theory. According to this idea, if more animals are watching for danger, that danger will be spotted sooner than if just one or two animals are watching out. This theory works for any animal that could be preyed upon by other animals. Meerkats, for example, are predators of small animals such as scorpions, but they are prey for animals such as hawks. When some meerkats watch for danger while other group members feed, it ensures that several sets of eyes are always looking for an approaching predator.

Many eyes may also help animal groups to find food. Each individual in the group benefits when one animal spots food, whether it is plants, berries, or prey. The whole group can take advantage of the food source. Group living also helps animals to protect their food supply. Groups can claim and defend a territory against other groups of their **species**. In this way, all the animals in the particular group have access to a food supply.

Group living provides another anti-predator benefit that animal scientists have named "**You first!**" When a predator spots a lone animal, that animal will be stalked and hunted. Living in a group lessens an animal's chances of being attacked because the predator has many animals from which to choose. The larger the group, the less likely it is that any particular animal will be singled out. This advantage of group living is most noticeable in large groups of animals, such as fish or reindeer.

Large groups of prey animals are also visually confusing for predators. As the prey animals run and dart about in panic, the

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The confusion caused by a group of darting animals, as well as the enhanced ability of multiple animals to watch for predators, are advantages of group living. Here, a lioness in Kenya preys on a fleeing herd of zebras.

effect is so confusing that often the predator can't concentrate on just one animal. As a result, the attack fails and every animal escapes.

Finally, as is the case with both meerkats and elephants, group living helps the young survive. Babysitters, aunties, and other helpers ensure that baby animals are protected and grow up to be valuable members of the group. This behavior helps the group itself to survive. In intelligent social groups, such as meerkats, elephants, and primates, young animals learn from all the group members. This means that groups can pass on their

culture to the next generation. Culture is behavior that is learned through watching or interacting with other group members. Scientists believe that primates have true cultures. Most primate behavior is learned within a group and passed on from adults to young. Different primate groups may learn different things and have different ways of interacting with one another. For example, some groups of monkeys, called Japanese macaques, live near beaches and have learned to wash their food to remove the sand. Other macaque troops do not perform this behavior. And groups of chimps may use rocks or sticks as tools to crack nuts or as weapons because they have observed such tool use as they were growing up.

## DISADVANTAGES OF GROUP LIVING

Living in a group seems to benefit individuals, but there are disadvantages, too. For example, no animal can claim all of the food resources for itself. The group must share food, and sometimes an animal does not get enough. There may be fights over food and water. For animals to get along in a group, this kind of aggression can't go too far. Often, that means animals must be **submissive** to dominant leaders, or alpha animals. The submissive ones have to give in when a dominant animal wants access to food, water, or a prized resting place. A **hierarchy** among group animals may be established so that each animal has a **status**, a place in the group. Within the hierarchy, each animal must submit to any animal with a higher status. For animals with a low status, group living may be a serious disadvantage. They may be injured in fights, fail to get enough food, or be unable to make choices about when to mate or even where to sleep safely.

Groups of prey animals may benefit from many eyes or visual confusion effects, but the group itself can also be a disadvantage. A single animal can hide from predators, but no large group can

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do that. The group is obvious, and many individuals are attacked when hungry predators find it. Some individuals even sacrifice their lives for the good of the group. Honeybees protecting their hive, for example, die when they sting a predator. Dian Fossey saw male gorillas stand and fight predators to give their families time to escape. When the predators were human poachers with guns, the male leaders still refused to run away.

### IT'S IN THE GENES

Sociobiologists try to understand social behavior by how it evolved. They wonder why animals would apparently suffer and sacrifice themselves for the good of the group. This behavior seems to violate the theory that each individual acts to increase its own chance of survival. Scientists assume that behavior is determined by evolution and natural selection so that only those behaviors that improve the chance of survival will be passed on. This idea is sometimes known as “survival of the fittest.”

It does not seem very “fit” to die in defense of the group. But “fittest” does not mean strongest or smartest or longest lived; it means most able to mate and pass along one’s **genes**. Those individuals that pass on their genes to their young are successful. Behaviors that do not lead to mating success die out and disappear. That is what natural selection is all about—behaviors that increase the chance of mating, reproducing, and passing genes to the next generation.

Genes are the strings of DNA instructions in the cells of all living things. Scientists say genes are like the words in a giant book that provides the chemical code for the development of life. Genes code for whether a living thing is a human, a meerkat, or a daisy. They also code for many traits, including not only eye color or the shape of a nose, but also some behaviors, such as the preference for living in groups. Each individual has thousands of

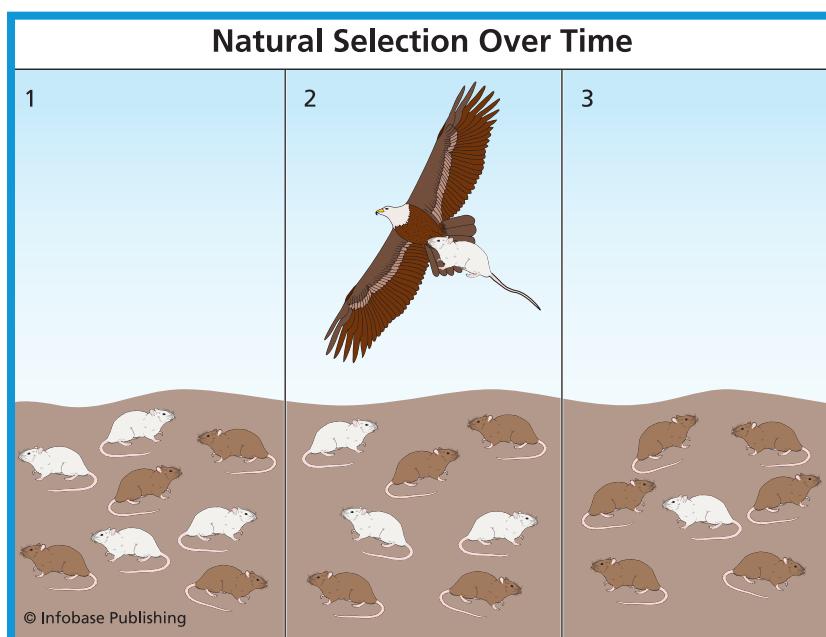


In an example of primate behavior learned within a group, Japanese macaque monkeys who live near beaches learn to wash the sand off their food, while other groups of these monkeys do not. Above, two macaque monkeys groom each other while sitting in hot springs.

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genes. These genes are passed on, or inherited, from the parents. Half of an animal's genes are inherited from each parent; which genes were given and how they are combined in the offspring determines the looks and traits that are unique to each individual.

When two animals mate and have young, the new babies' genes are inherited from both parents. Sometimes, genes are changed in their journey from parents to baby. If the changes help the individual to succeed in growing up and having babies, the changed genes will be passed on to future generations. If the changes make reproducing impossible, they aren't passed on.



Natural selection means the fittest animals survive. This example shows that in a population that includes mice with white and brown fur, the white mice will be most easily spotted by predators and more easily become prey. As a result, the white mice have less chance to reproduce. Over time, brown fur will be "selected" within the group because the brown animals are the ones that tend to survive and reproduce. Most of the animals in the group will have genes that code for dark hair.

This is how evolution proceeds, according to the theory of natural selection. Thicker fur, longer legs, bigger brains, self-sacrificing tendencies—all may have developed by accident and then become more widespread, just because more young survived in animals with these traits. Gradually, usually over thousands of years and many generations, different kinds of animals with different ways of living came to be.

## SELFISH GENES

According to many sociobiologists, everything an animal does is not for its own survival or for the survival of its group, but for the survival of its genes. Evolutionary ethologist Richard Dawkins originated the idea that genes are selfish—they want to make more of themselves and survive for generations. Living things are just the way that genes accomplish this. If animals are the strategy by which genes replicate themselves, then group behavior should help the individual's genes survive. Even group behaviors that don't seem selfish—such as sharing, cooperation, and affection—must somehow benefit an individual animal's genes. An individual may behave in helpful and even **altruistic** ways, but its genes are always selfish.

Not everyone agrees with Dawkins' theory of selfish genes. Some researchers and philosophers say that individuals do make choices and are not just "robots" driven by their genes. Dr. Peter Corning, a behavioral genetics expert and director of his own institute, believes individual animals can help each other because of true altruism, not gene selfishness. He says that two animals that cooperate together are helping each other and the group to survive. Thus, he believes that different kinds of groups develop or evolve different behaviors that benefit the

## **ALTRUISTIC VAMPIRE BATS**

**Female vampire bats live in caves in small groups that include their offspring, other females, and a few young adults. The adult bats in each group usually are not related.**

**Vampire bats feed only on blood. They quietly land on the ground next to a sleeping animal, creep up to it, make a small cut on the animal with their sharp teeth, and lap up the blood that flows from the wound.**

**A bat needs about two tablespoons (30 ml) of blood every night. When it is successful in finding a meal, its stomach becomes round and full. If a vampire bat misses a meal for two nights in a row, it will starve to death. Not all bats can find a meal. Every night, about 3 of every 10 bats fail to find blood. But they do not die. At the end of the night, when the bats return to the cave, a hungry bat goes to a stuffed bat and grooms its fat stomach. The full bat then gives some blood to the hungry one. This behavior looks altruistic, but according to Verna Case of Davidson College in Davidson, North Carolina, it is not. The well-fed bat is guaranteeing its own survival by being generous and sharing. At any time in the future, this bat can expect the same help when it has had a hungry night.**

**The bats are able to tell which bats have food to share by the shapes of their stomachs. They also remember which bats shared food in the past. Some bats cheat: They are given food, but do not return the favor. But the bats learn who these cheaters are, and then refuse to share with them. The altruism works only when the favor is returned. Scientists say that vampire bats need this system because they often fail to find food, and yet need to eat regularly. Because the sharing is a survival strategy, it is actually selfish, both for the bats and for their genes. The genes of sharing bats are successful genes. They are likely to live on, because sharing bats stay healthy and live to produce and raise young. Those who cheat are weeded out of the group, die of starvation, and fail to pass along their genes to the next generation.**

entire group. Benefiting the group then benefits all of its members and makes the group more fit.

So far, however, most modern researchers think that the selfish gene theory is the best theory. Scientists and observers of wild animal groups look to see if group behaviors match this theory. They look at all kinds of animal groups, from the most primitive to the most complex, for evidence that supports it. From insects to primates, they say, selfish gene theory can explain every behavior that observers see in the animal groups.

# 3

## Colonies of Ultimate Cooperators

**THE FIRST INDICATION** that they are on the move is an ominous hissing sound. Then, should any living thing even twitch in a panic to escape, strong pincer-like jaws grab and tear at flesh. With dozens, hundreds, thousands of fiery bites, the victim is overwhelmed and torn to pieces. They seem to act as one animal, or at least under the direction of a single brain, but they do not. They are African army ants on the hunt, and they are members of groups that are some of the most coordinated and cooperative on Earth.

### EUSOCIAL INSECTS

Groups of army ants are called colonies. One colony may include millions of ants. The ants are eusocial. Eusocial insects form complex social groups with three main characteristics. First, there is a division of labor. Second, each ant belongs to a caste, or subgroup. Each caste has a special job. Third, three or more generations live together in the colony. All the insects protect and raise the young, even though most never mate and



Army ants are born with the instinct to function as part of a group. These African ants exemplify how soldier ants gather in lines to guard a central column of worker ants as they cross a road in a Ghana rainforest.

reproduce. All species of ants are eusocial, as are honeybees, termites, and some wasps.

Eusocial insects are so tightly organized that they seem to behave like a single organism, but they have no leader or collective mind. The insects do not make choices or decisions. They do not have emotional bonds. All of their behaviors seem inborn. This means they operate on instinct; their actions, no matter how complicated, are not learned. Each eusocial insect is born knowing its function in the group. Most eusocial behaviors are performed for the good of the group. Some ethologists say that eusocial insects act like the individual cells in a single body,

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cooperating with all the other cells for the good of the organism. Certainly, a colony of army ants seems to operate in this way.

### LIFE AS AN ARMY ANT

Army ant colonies live in the tropics, mainly in South America and Africa. There are more than 200 different kinds of army ants, but the most vicious ones are the African army ants, also known as driver ants. In his 2001 book, *A Primate's Memoir*, researcher Robert Sapolsky says that these army ants “are the single most disgusting, disquieting, panic-provoking creatures in all of Africa.” When he was observing baboons, he grew to hate the ants because they made his life and his work so difficult. In his book, he explains, “They come in swarms that cover square acres. They are huge with pincers that take pieces of meat out of you. They crawl all over you silently, before a single one bites, and then through some pheromonal alarm signal, they all attack at once. They eat your eyelids and nostrils and soft parts. They attack anything, kill invalids who cannot run away from bush hospitals.” One African army ant colony can include more than 20 million individuals.

The colony is made up of a queen and generations of her young. The queen can lay more than two million eggs each month. When the eggs hatch, out come worm-like, helpless creatures called **larvae**. The larvae grow quickly, and then form cocoons as butterflies do. In this stage, they are called **pupae**. When the cocoons open, full-grown ants emerge. Most of the ants are workers and soldiers. All workers and soldiers are female ants. A few female ants are immature queens. They do not become full, reproducing queens unless the old queen dies or they leave to start new colonies.

Male army ants live in the colony only a day or two. Unlike the other ants, the males have wings. They fly away, searching

for colonies where they can mate with a queen. When a male ant lands near a new colony, its worker ants capture him, tear off his wings, and carry him to the colony. He lives there a short time, mates with the queen, and then dies.

A colony of African army ants actually doesn't have a permanent home. "Home" is a temporary camp, or bivouac. It is usually located at the base of a large rock or tree. Sometimes, it is underground. Its walls are made of the worker ants themselves with soldiers guarding the edges. The ants lock their legs and jaws together, sheltering and defending the queen and her eggs, pupae, and larvae. Thousands of "wall" ants will sacrifice themselves to protect the queen and the young. Soon, thousands more replace



Army ants carry prey back to their bivouac across a bridge made of living worker ants in a rainforest in Trinidad.

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them from the pupating young. Worker ants feed the young and the queen. They also break open the cocoons when new ants are ready to emerge.

African army ants move around to find food, so they move their bivouac from site to site in the jungle. As the colony travels, the worker ants carry the larvae and pupae to each new camp.

The workers form the main body of a huge moving column, and the soldiers march at the edges with gaping jaws ready to defend the colony. In the center of a ball of worker ants, the queen is hidden and protected during the march. Soldiers are arranged around the ball, ready to fight and die for the queen. The column moves as one, but amazingly, the workers and soldiers are all blind. They can stay together because they give off chemicals known as pheromones. The pheromones lay a trail that all the ants pick up and follow, either to a new bivouac or on a hunting trip. Pheromones help the ants to attack in concert, too.

## **ATTACKING AS ONE**

Any living animal in the path of the column is suitable prey. Most kinds of army ants cannot bring down animals any bigger than worms, insects, or small reptiles or mammals. African driver ants are different. They have been known to kill humans who cannot run away. They can strip a human body of all flesh in about four hours. Army ants attacked Sapolsky as he slept in a mountain hut during a camping trip. He wrote in his book that each bite was like little flames on his skin. He escaped, but it took him several minutes to pull off his clothes and kill all the biting ants that were attached to him.

African driver ants can kill a cow. They spend weeks carrying the flesh home to the bivouac. The secret to their success is not only their huge numbers, but also their ability to attack all

together. When an animal moves, even slightly, the ants crawling on it give out a pheromone alarm signal, and then all the ants bite simultaneously. Any ants that are not yet crawling on the animal will surge forward and join the attack. Every bite is a bit of meat carried to the bivouac to feed the queen, the young, the worker “walls,” and the soldiers. Soldier ants cannot feed themselves; their jaws are too big. Soldiers rely on worker ants to feed them.

The more food available to the colony, the more eggs the queen can lay and the more larvae grow to adulthood. Sometimes, the colony gets too big. When this happens, a young queen matures and leaves with several thousand ants to form a new colony. No one knows how the ants “know” when to go, or why certain ones follow the new queen. The ants move off as one, as if each ant knows what the others will do.

## **ALL IN THE FAMILY**

Scientists believe that colonies of army ants are excellent examples of selfish genes at work. All of the workers and soldiers are sisters. This is because the queen usually mates only once in her life. She stores the male’s sperm in her body. There, it combines with her eggs. Because the workers and soldiers are sisters, they have many genes in common with one another. They also are the sisters of the larvae and pupae. The colony has the “common” goal of passing on these genes to future generations, even though only the queen reproduces. When a soldier dies in defense of the bivouac, she is protecting her own genes within her many sisters. She defends the young and the queen, who will live to produce more generations of sisters. Selfish gene theory seems to explain why eusocial insects have developed their complex societies. All the different castes are working toward the survival of the genes that they share.

## EUSOCIAL HIVES OF HONEYBEES

Honeybees also live in colonies with related castes that work for the survival of common genes. A honeybee group is very similar to a group of army ants, but there are differences. Honeybees live in a stable, permanent home called a hive. One hive may include up to 60,000 members. It consists of the queen, thousands of workers (female bees), and a few hundred drones (male bees). The queen is the largest bee in the colony, but despite her name, she is not the leader. She is only an egg-laying machine. During the late spring, she may lay 2,000 eggs each day. A worker bee lives only about six weeks, so the queen must produce one generation after another. She lays her eggs in the cells of the honeycombed hive. In large cells, she lays the eggs that will become the drones. Most eggs are laid in small cells; these become worker bees. They are the queen's daughters, but they cannot lay eggs of their own. They are sterile.

Drones do not work. They mate with a queen, if necessary, and are fed by the workers. Each fall, the workers drive the drones out of the hive, and the drones die. No eggs are laid in the winter, so the drones are not needed as mates.

The workers keep the hive functioning. What jobs they do depend on how old they are.

## SPECIALIZED WORKERS

Like army ants, honeybee eggs hatch as larvae and then pupate before becoming adult bees. New honeybee workers emerge from their cocoons knowing what job to do. The labor is an instinctive one. No learning is necessary. As a worker bee ages, changes in the glands in her head determine the role she plays in the hive, and she automatically begins to perform her correct function.

## NAKED MOLE RATS

The naked mole rat is the only known eusocial mammal. Colonies of wrinkly, pinkish-skinned naked mole rats live underground on the savannas of Africa. They dig tunnels to search for food, and eat the underground roots and tubers of plants. One colony can include up to 300 naked mole rats. These colonies are very much like insect colonies, with castes, division of labor, and cooperative raising of the young. Every individual works for the good of the colony.

One female is the queen, and she is the only naked mole rat to mate and have babies. Two or three males form the caste similar to honeybee drones, and they mate with the queen. The rest of the adults, both male and female,

*(continues)*



Naked mole rats depend on group life in order to survive and are not able to live on their own. They dig underground tunnels for protection from predators and to search for food.

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*(continued)*

**are either workers or soldiers. They are all grown offspring of the queen.**

**Soldiers defend the burrow and tunnels from predators, such as snakes, and from other naked mole rats. Workers clean the burrow, search for food, and feed the queen and the young. When a worker has tunneled to a good food source (such as a giant underground root), it bites off a piece and races back to the colony. There, it chirps and waves the bite in the air. The other workers pick up the scent and follow the discoverer back to the food. They harvest it, return with it to the burrow, and share the food with the colony. A naked mole rat colony is so dependent on cooperation that individuals cannot survive alone. When a naked mole rat of any caste is separated from its colony, it will die.**

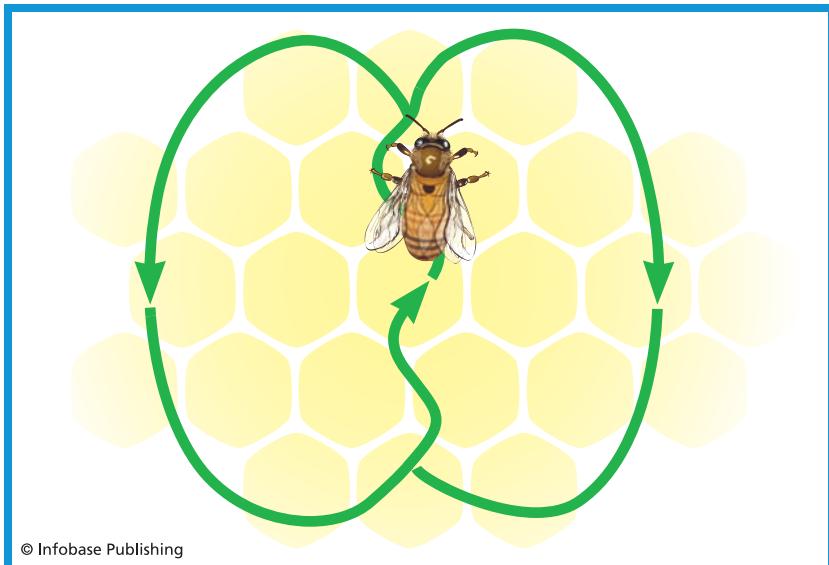
During the first two days of workers' lives, they are the housecleaners. They clean up the old honeycomb cells to make room for new eggs. They also warm the hive when it gets too cool by beating their wings. When they are about three days old, their jobs change; now they are nursemaids. They feed the developing young with nectar brought to them by older worker bees. When they are about 12 days old, the bees become construction workers. Their bodies produce wax, which they use to construct new honeycomb. They are also the undertakers, removing the bodies of any dead bees and keeping the hive clean. Then jobs change again. When they are about 18 days of age, the workers become the sentries and soldiers. They guard the hive from enemies and are ready to give their lives in its defense.

Finally, when the workers are three weeks old, they fly from the hive to search for food and water. They collect nectar from flowers and return it to the hive. The queen, the drones, other workers, and the young are fed through their efforts. Any extra nectar is turned into honey, which is used for food during the winter. None of the workers that provide the extra nectar will live to eat the honey. Because they live but 4 to 6 weeks, they will have died long before winter arrives. The workers labor for the good of generations to come, not for themselves.

## **COORDINATING EFFORTS**

Instinct drives worker bees, but no matter how well programmed they are, the individuals in a eusocial colony must communicate with one another if the colony is to thrive. Army ants leave pheromone trails. Honeybees use chemical signals, too. They recognize one another this way, and can identify dead bees by their odors. Honeybees also dance to communicate the location of rich food supplies. Sometimes, a foraging bee finds a large source of nectar that she cannot collect by herself. To get the help of other workers, she returns to the hive and performs a “waggle dance,” which the other workers can interpret. She first moves in a circle, then takes off in a straight line, and then moves in another circle, so that in the end, the dance makes a shape like a figure eight. The faster she dances, the closer the food source is. When she dances slower, the food is further away. The slower she goes, the greater the distance to the food source. But the worker is able to communicate more than distance. She can also dance out instructions about the position of the food in relation to the hive. She does this by using the sun’s position as a marker. If the direction of the food is directly toward the sun, she moves straight, or vertically, up a wall of the

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The figure eight-shaped bee waggle dance is used by scout bees to tell the other bees in their hive the distance and direction to food.

honeycomb. If the food is, for example, 40 degrees to the right of the sun, she waggles 40 degrees to the right of the vertical. Every worker watching the dance orients herself to the food by seeing the angle away from the vertical that the dancer describes. Then the watching bees fly to the food source, using the position of the sun as a guide. They stuff themselves with nectar to bring back to the colony.

These complex behaviors are **innate**, or inborn. Each bee is born knowing how to dance and how to interpret communications. Its genes code for every job that must be done to keep the colony healthy, including the instinct to defend the hive by stinging predators. Much of what the bees do seems unselfish because their behaviors help the colony, not themselves. The common goal is the colony's survival.

## **SELFISH GENES SURVIVE**

The behaviors of all eusocial insects are marvelously complex and ordered. Their groups seem to function as smoothly as clockwork. Workers and soldiers may seem unselfish, but they are behaving in accordance with their genetic instructions and without thought. Their instinctive behaviors have been successful at helping the hive survive, and therefore passing on the genes of the related members of the hive. Workers or soldiers are passing on their genes, even though they never mate. The genes of the group survive and are passed on to the next generations. Eusocial groups seem to be good examples of selfish genes at work.

Most animal groups do not use such rigid social organization, nor do they arrange themselves in castes. Some animal groups seem simple compared with eusocial insects, but these groups also help the members and their genes to survive.

# 4

## Schools and Flocks

**A SCHOOL OF FISH** may be made up of thousands, even hundreds of thousands, of individuals. The thousands of fish move as one. They swim, turn, and flash through the water in almost perfect harmony. Sometimes, a school of fish can be so large that sunlight is blocked out in its center. Yet, the fish never bump into one another or lose the fluid movement that seems to be directed like a group dance. The school looks like it moves with a single mind. When the fish are startled, the school moves and flashes like a waving, rippling ribbon, but there is no leader, and the fish are not even related to each other.

### JOINING A SCHOOL

Scientists have long been fascinated by fish schools. They wonder how the fish can be so well coordinated and why fish gather in schools. There is still much that observers do not understand, but scientists do know that fish of the same species are attracted to one another. According to the University of Rhode Island's Sea Grant Program, about 80% of known species of fish join schools for some part of their lives. Almost always, these schools are made up of the same species. Herring, for example, school

with other herring, not with mackerel. Schools of small fish do their best to stay clear of schools of piranha. Fish do not seem to form social or emotional bonds with each other, but they do seem to have an instinctive attraction to others of their species and to the school. In one laboratory experiment, roach fish swam toward the odor of other roach fish, and away from the odors of different fish species.

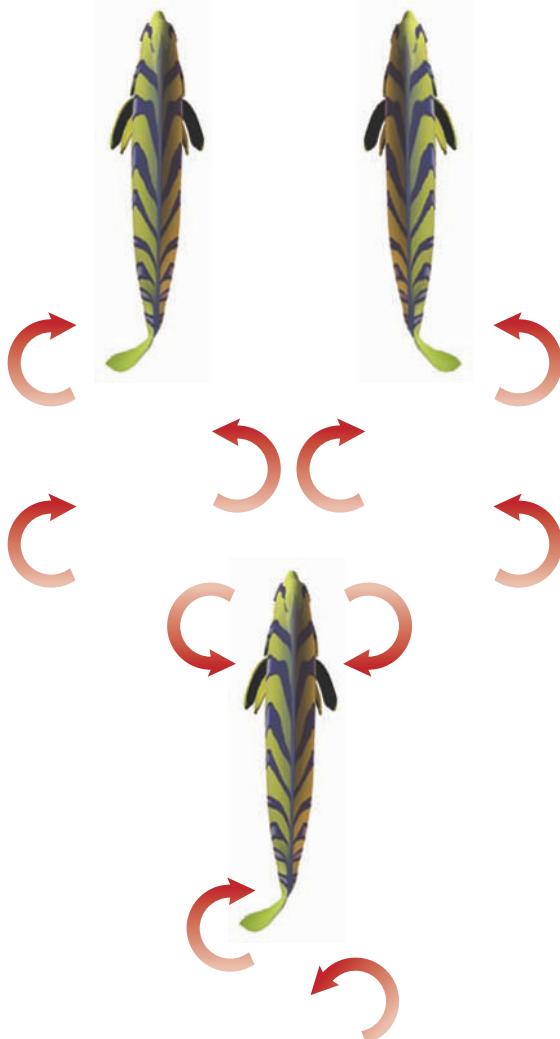
Scientists assume that swimming in a school is a survival strategy. The individuals in the school are not bonded to one another. A school is a **selfish herd**. Sticking with the school helps each individual increase the chance that it will survive, mate successfully, and pass on its genes.

## SAFETY FIRST

As with other prey animals, many eyes help the group to spot danger. Plus, because the fish in the school move in **synchrony** with one another, they may fool a predator into thinking they are one large animal. This visual confusion benefits all of the fish. Their synchrony is possible because fish have a special sense that other animals lack. Fish have a vibration sense along the length of each side of their bodies. This is called a lateral line system. It is something like a combination of touch and hearing. From a distance, fish can feel what other fish are doing and where they are swimming. Because fish have eyes on either side of their heads, they can also see what neighbors on each side are doing. Using its senses, a fish can match its body movements to those of its neighbors. When every fish instinctively does this, the school moves in synchrony.

Even when a predator does not think the school is a big animal, the synchronous group can be confusing. If the school turns and flashes through the water, it can be hard for a predator to focus on just one fish. Stragglers are easily singled out and eaten, though. Most likely, fish that are not skilled at matching their

### How Schools Help Fish Travel



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Fish create vortices with their tails when they swim, making it easier for fish in a school to move through the water. Schools enable fish behind others to move through the water more easily and conserve energy.

neighbors' movements are eaten before they are old enough to mate. They do not survive, and neither do their genes.

Swimming in a school has another big advantage for its members. It is a way to conserve energy. When a fish swims, it moves its tail. This creates little whirlpools in the water called vortices. Vortices made by one fish reduce the water's friction for the fish swimming behind it. This makes it easier for that fish to swim. Scientists have done experiments that show that fish in the center or at the rear of a school move their tails less often than fish at the front or on the edges. But swimming at the front or edges of the school makes it easier to find food. In 1996, two scientists, E.M. DeBlois and G.A. Rose, studied stomachs of fish in a school that was 6.2 miles (10 kilometers) long. Fish in the front of the school had fuller stomachs than fish in the back. Thus, position in a school has different advantages. Fish in the back use less energy, but fish at the front get more food.

Swimming in a school helps fish find food, but they do not share it or help each other reach it: It is every fish for itself. Scientists believe that hungry fish choose to swim at the outer edges or front of the school. That gives them the best chance of finding food. Swimming in these positions, however, is tiring and dangerous. Fish on the edge of a school are most obvious to predators. They also don't get to "coast" off the vortices made by other fish, so fish that are not hungry stay in the center of the school. That is the safest, most comfortable place. Scientists believe fish move around inside the school depending on their needs.

## **SHOALS FOR SURVIVAL**

Not all groups of fish are as tightly synchronized as schooling fish. More loosely organized groups, sometimes of varying fish

## HIDDEN IN THE SCHOOL

**Scientists with the Census of Marine Life discovered the largest fish school ever recorded in 2006. It was a school of herring that swarmed in the ocean off the New Jersey coast. The school contained 20 million individuals and covered an area the size of the island of Manhattan in New York City.**

**Such a huge school is unusual, but scientists believe that the size of a school is a survival strategy that provides the most protection from predators. Apparently the shape of the school matters, too. Most schools form an oblong shape. This is because every fish is attracted toward the center of the group for protection. As the fish move slightly toward the center, the width of the school is reduced. The larger the school, the more oblong it becomes. The front of the school is the most densely packed. Since the front is a dangerous place, the thicker the fish are, the more each individual fish is protected from predators. Also, fish of the same size (and age) seem to cluster together. Scientists think this is a protection strategy, too. If a smaller fish swam with larger ones, it would look different and stand out to predators. Scientists are discovering that the makeup of a fish school and its advantages can be very complicated.**

species, are called shoals. Shoals also help protect individuals from predators and increase the chance that all of the fish will find food. Minnows and shiners are examples of shoaling fish. They are small groups of fish that swim together and hunt food together, but do not match movements with one another.

Members of a shoal swim in different directions while seeking food. They keep their eyes on one another and follow any fish that are feeding. If predators attack, the members of the

shoal swim in all directions. These darting movements make it hard for a predator to single out any one fish.

Like schooling fish, shoaling fish have no leader. Fish follow one another because they have an instinct to stay together. They also seem to learn from one another. In their book, *Living in Groups*, researchers Jens Krause and Graeme D. Ruxton describe a study by Stephen G. Reeks that showed that fish can follow leaders and learn from them. In 2000, Reeks taught 12 shiners to come to a certain place in his large fish tank for food. Once the fish learned where they could expect to be fed, Reeks split them up. He placed one, two, or three trained fish with a



These minnows in a lake are swimming in different directions—an action which works as a defense against predators. Many darting fish distract a predator from being able to single out one to eat.

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group of untrained but hungry fish. When the hungry, trained fish swam to the right spot in the tank, all the untrained shiners followed close behind. They did this even when there was no food in the tank. The trained fish were the leaders that the other shoal members followed.

Some scientists believe that hungry fish swim more purposefully than others. This causes other hungry fish to follow them. In the wild, scientists think that older fish may have more knowledge of food resources. They may be the “leaders” as the group moves from place to place.

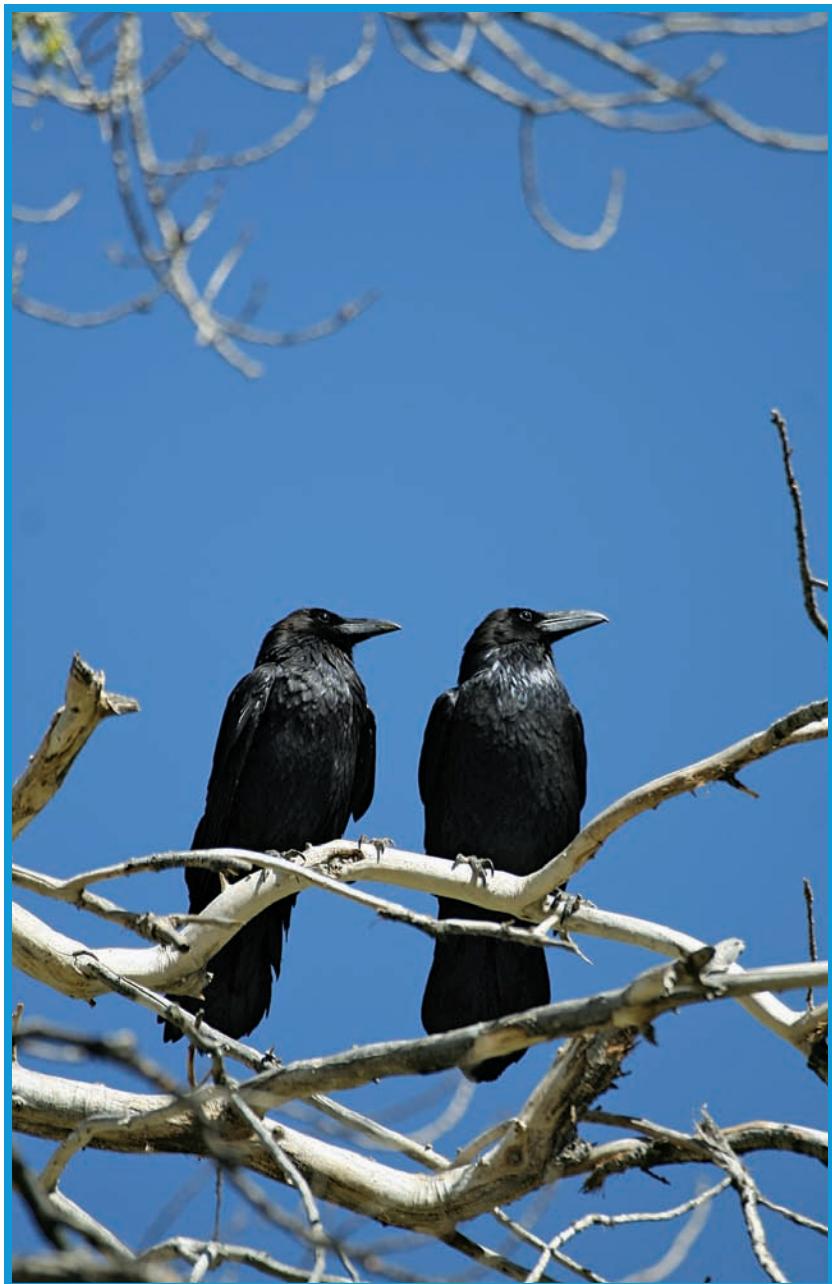
## BIRDS IN GROUPS

Fish that school and shoal in water—where there are few hiding places—are much like birds flocking in the air. Flocks of birds are quite similar to groups of fish. The advantages of living in the flock include many eyes, visual confusion, and knowledgeable older birds with experience in finding food. Staying with the flock is a survival strategy.

About 80% of all bird species live in flocks for some part of their lives. Many are solitary during parts of the year, but some live in flocks almost all the time. Bird expert Roger Tory Peterson once wrote that birds are “naturally **gregarious**”: They just like to be together. Scientists still have a lot of questions about bird groups and their social behaviors, but they do know that there are different kinds of flocks. Birds may gather in foraging flocks, breeding flocks, or migratory flocks, depending on their needs.

## A SOCIETY FOR ALL SEASONS

Crows, which are among the most intelligent birds, spend most of their lives in groups. During the spring breeding season, they



Crows live in family groups in which the parents are dominant and the older offspring stay with the family to help raise younger crows.

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live in small family groups. The group consists of two parents, their grown offspring from the previous year, and the current year's young. The parents are dominant. They mate, and then build their nest together. While the female parent sits on the eggs, the male feeds her. When the eggs hatch, both parents feed and protect the young. Their grown offspring are helpers. They assist in feeding the newly hatched young and continue to do so even when the young leave the nest, or fledge. Throughout the summer, all the family members forage together. They also concentrate on feeding and caring for the young. The group defines and protects a territory, both from other crows and from predators. If a snake is spotted, for instance, the family mobs it until it leaves, shrieking and dive-bombing it.

Helpers do not mate, but instead work to feed and protect their new siblings. No one is sure why helper crows do this instead of leaving to mate and having young of their own. Scientists have studied families of crows that have helpers and compared them to crows that are first-time parents (without grown young to act as helpers). The scientists did not find that the families with helpers had more young crows survive. Therefore, family groups do not seem to help kinship groups survive and pass on common genes. It could be that helper crows are learning to care for fledglings, preparing for when they will be parents themselves. Or maybe they just like to be together. Crows do seem to be very social. Usually, birds in flocks do not like to touch each other, but family groups of crows often preen each other. The birds stroke and smooth each other's feathers with their bills and pick out any dirt or lice.

## **ROOSTING EN MASSE**

When summer is over, family groups of crows gather together in huge flocks called roosts. Throughout the winter, the roost stays



Crows mob and harass a predator by flying at it, emitting alarm calls, and sometimes making physical contact. These two crows are mobbing a hawk.

together. It may consist of thousands of birds. They sleep together in trees each night and forage for food by day, either together or in smaller flocks. Sentries guard the roost and the foraging groups. When a sentry sees a predator, it screams an alarm. The crows respond by mobbing the predator. Crows use harsh caws to respond to alarm calls and help scare off predators. They may caw at each other, too, when a squabble breaks out over food or sleeping places. Roosts can be noisy places with many quarrels. Dominant individuals usually win by using vocal threats or running at rivals. An angry crow may peck at a rival, but most of the

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time no one gets hurt. One crow gives in and moves away, and that stops the fight.

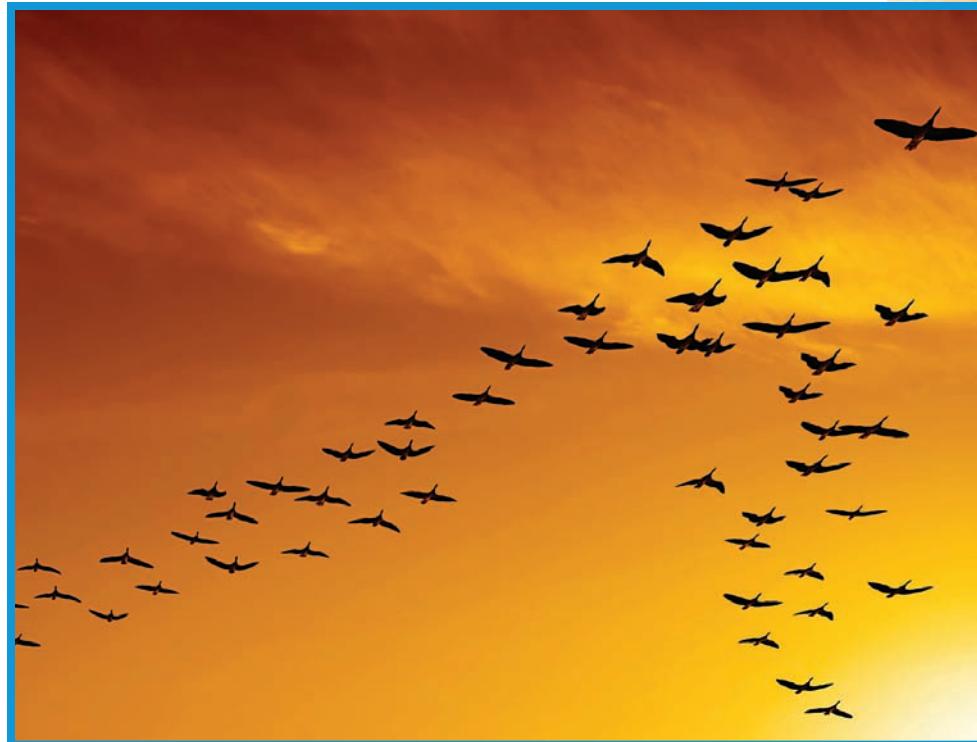
Crows are not quarrelsome all the time. Eric Strauss, a biologist at Boston College, says that roosts are “information centers” and “mutual-aid societies” for crows. They notice when a crow finds a rich food source, and follow successful birds to the food. They communicate with one another using at least 35 calls, although scientists do not yet know what all of these calls mean. Crows find their life-long mates within the roosts during the winter. Within the roosts, family members bow to one another and make soft cooing sounds. Scientists are not sure what these signals mean, either, but they think they are ways that crows recognize, greet, and bond with one another.

## **FORAGING WINTER FLOCKS**

Crows are unusual because they socialize year round. Most birds avoid flocks during spring and summer. Instead, they form pairs for nesting and raising young. Chickadees do this. Once their young are grown, chickadees gather together in small flocks for fall and winter foraging. One flock is made up of about 10 birds. It may include a dominant pair, other non-dominant pairs, single adult birds, and some young birds. The flock claims a feeding territory, which they defend from other chickadees. Chickadees do not share food or preen each other, but they seem to like to be together. As they are foraging, they continually give “tsee tsee” calls to help them stay in contact with the group. Observers believe that the winter foraging flock helps chickadees find and protect enough food sources to survive the winter.

## **MIGRATING FLOCKS**

Some birds form flocks for traveling, or migration. Geese fly to and from their winter homes in tight V-shaped formations. They



Just as schools help fish conserve energy, flocks allow flying birds to do the same. This flock of migrating Canadian geese is flying in a V-formation. The shape helps birds in the rear follow behind vortices made by the leader birds so they do not have to flap their wings as much as they travel through the air.

coordinate their movements, like fish in schools do. Scientists believe the V-shaped formations help geese to conserve energy during long migratory flights. Tired birds slip to the rear, where the wings of the birds ahead of them make vortices in the air that make flying easier. Birds at the rear flap their wings less. After a bird is rested, it takes its turn at the head of the flock, and previous leaders slip back and take a rest. Swans and ducks migrate in flocks for the same reason. These birds are more likely to survive a long, tiring migration when they fly as a flock instead of on their own.

## A NEED FOR A CHICK

**Each pair of emperor penguin parents is extremely attached to its chick. If a chick dies, female penguins may try to kidnap a chick from another penguin pair. As a result, fights can break out. Usually, the true parents are successful in protecting their chick, but sometimes the kidnappers win. Most kidnappers care for the chick for only a few hours. Then they abandon it, and the chick dies.**

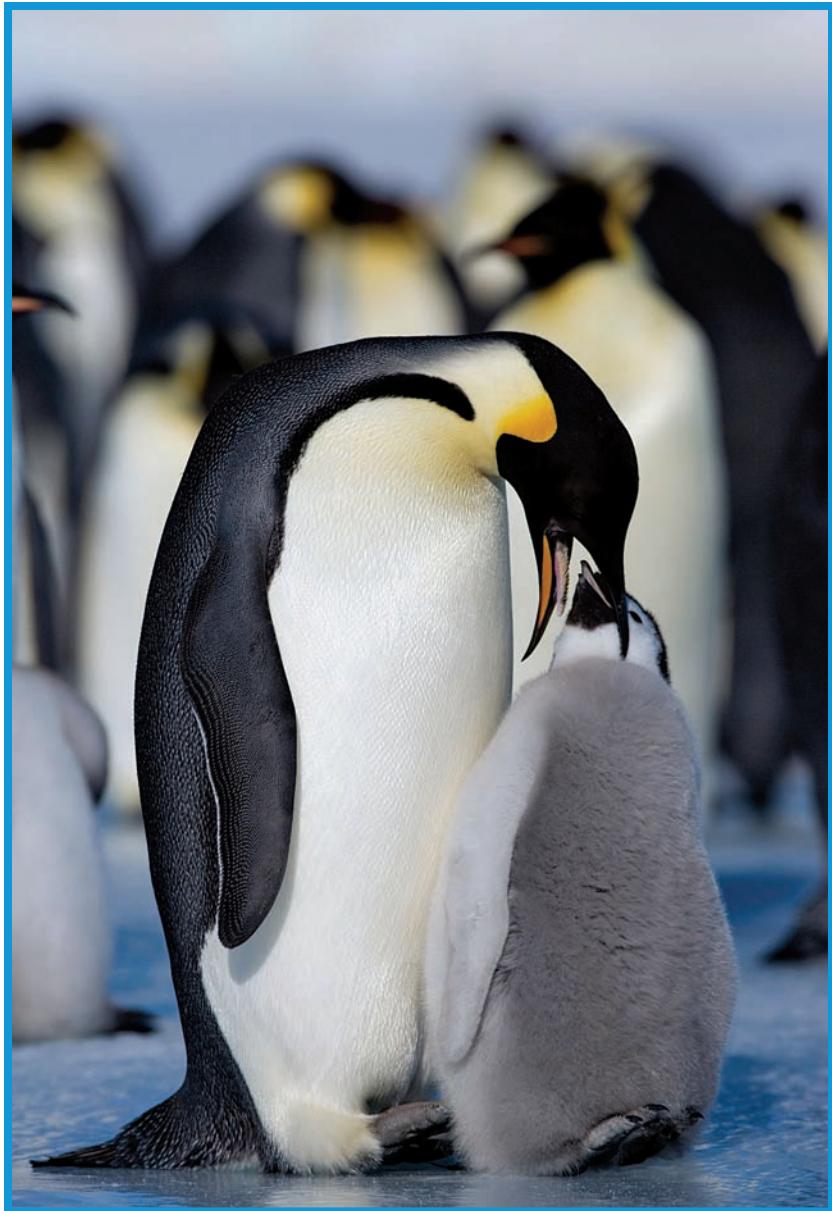
**Scientists don't know why penguins kidnap chicks only to abandon them. Some scientists have a theory that much of a bird's behavior is instinctive, and one powerful instinct is the need to care for a chick. Chemicals called hormones are produced when penguins lay eggs. Some scientists say that perhaps these hormones make penguins feel the need to feed their chicks. So even if a female's chick is dead, she still needs to feed a begging penguin chick.**

**Penguins recognize their chicks by begging calls. The calls are how parents find their chicks when they return from hunting trips. Because the kidnapper does not recognize the calls of the kidnapped chick, she quickly loses interest in it.**

## A BREEDING FLOCK

There are more than 10,000 species of birds in the world. Only about 13% of them form groups during the breeding season instead of nesting secretly. Flocks of breeding birds are called colonies.

Penguins nest in colonies. They lay their eggs and raise their young in groups that can number in the millions. Each pair of penguins establishes and defends a tiny nesting territory that can be only inches from its neighbors. Each nesting pair is selfish



An emperor penguin feeds its young regurgitated food. Parents and their chicks maintain strong bonds until the young penguins are able to care for themselves.

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about its own food and feeding its new chick. The birds do not cooperate with one another to raise the young, but the colony protects its penguin chicks by its sheer size.

In Antarctica, emperor penguins huddle in large groups, which provide warmth during freezing storms. When penguin parents leave the colony to feed in the sea, they go in groups and often cooperate in hunting fish. One penguin alone cannot snatch many fish before a school escapes, but a flock can circle and corral fish prey. Each feeding parent has a good chance of stuffing itself and returning to its chick with plenty of food. Then, the parent can regurgitate, or vomit, the mashed food into the mouth of its chick.

Cooperative hunting means that each penguin chick's chance of survival is increased. Penguins may not be emotionally bonded with their colonies, but like all animals that live in groups, they do depend on the colony for their survival and the survival of their genes.

# 5

## Herds

**EVERY YEAR ON** Africa's Serengeti Plains, hundreds of thousands of wildebeest migrate. They leave dry plains and woodlands behind and follow the seasonal rains southward for several hundred miles, looking for fresh grass to eat. They may not be bonded to each other and they have no leader, but every wildebeest is dependent on the group.

Wildebeest herds are great examples of selfish herds. Each animal tries to stay safe in the center of the herd, where no predator can reach. The herd seems leaderless, disorganized, and even chaotic, but it drives forward as one, seeking the food it needs to survive.

### OFFERING UP A FEAST

February, when the plains are lush with green grass, is the time of greatest danger for a wildebeest herd. Thousands of female wildebeest give birth to calves in synchrony with one another. The birthing period lasts for about three weeks. Females lie down, give birth in about 10 minutes, and are on their feet as soon as possible. The calves are up and running within minutes of being born. Quick births and strong-legged newborns are

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Migrating wildebeest travel in a herd, like this one crossing the Mara River in Africa. Individuals may be initially hesitant to plunge into the river, but the urge to push onward, follow the herd, and find fresh grass to eat takes over.

essential to wildebeest survival because predators have been following the herd. Lions, leopards, hyenas, cheetahs, and jackals wait for birthing season. Every female on the ground is vulnerable to a predator. Thousands of newborn calves are taken as prey, even before they can get to their feet. On the open plains of the Serengeti, there are no hiding places. Only the calves and mothers that can run with the herd will survive the predator attacks. By taking wildebeest females and calves as prey, the predators help ensure their own survival and the survival of their young.

## THE HERD AS AN ADVANTAGE

Predators take so many calves that it does not seem as if a herd helps with survival. The large, noisy herd is obvious to predators. The thousands of daily births make it easy for predators to find calves. Nevertheless, scientists have discovered that wildebeest are safer in a herd than they are alone.

Wildebeest are large antelopes. They can grow to be 4.5 feet (1.4 meters) tall and weigh up to 600 pounds (272 kilograms). Such a big animal cannot hide from predators, especially on a treeless plain. In a large group, however, each animal can “hide” by being surrounded by thousands of others. Hundreds of thousands of animals are visually confusing. Usually, only the stragglers are in danger.

Adult wildebeest are powerful. They have large, dangerous horns. As a group, wildebeest can fight off single predators or groups of smaller ones, such as wild dogs. When faced by large predators, such as lions, some wildebeest will group together and approach, behaving aggressively and staring. There is no way for the predator to surprise a wildebeest. This group behavior gives the entire herd a better chance of survival.

The synchronous birthing is also a survival strategy. So many calves are born at once that predators can't eat them all. Calves born outside of the birthing season have a much smaller chance of survival. They are too easy for predators to see.

Once a calf survives its first month of life, it has a good chance of making it to adulthood. The calf has plenty of rich grass to eat, and the grass is available in the same areas at the same times. Those calves that get to their feet the quickest and learn to run the fastest are likely to make it through the first month. They will then probably find enough to eat, grow to adulthood, and pass on their genes to the next generation.

## **IN A BUFFALO HERD**

African buffalo herds are similar to wildebeest herds, but their behavior is quite different. Buffalo also live in selfish herds, but each herd numbers only in the hundreds. Instead of migrating long distances, a herd lives in a home territory. It moves from area to area within this territory while searching for grass to eat. Like wildebeest, buffalo have no leader, but they do something that amazes scientists: They vote on where to go.

Researcher H.H.T. Prins discovered this communication among buffalo. At first, he did not understand what the buffalo were doing. He would observe the herd during the day, while the



African buffalo communicate by standing, looking, and raising their heads in specific ways to decide which direction the herd should travel.

buffalo rested. He noticed that some females (called cows) would get up, move around, and then lie down again. After a while he realized that this was a form of communication. The cows stand in a certain way, look in one direction, and raise their heads slightly.

Prins put his observations together after many hours of watching the buffalo. He saw them getting up, moving their legs a bit, and then lying down again. Eventually, he realized that the cows held their heads in a unique position while they were staring. He noticed that their heads were higher than a resting position but lower than an alert (or startled) position. The head position and the shuffling of their feet seemed to have a special meaning. Prins discovered that the cows performed this pattern of standing, staring, and lying back down over and over for about an hour at a time. Then suddenly, at the end of the hour, the whole herd seemed energized and started moving.

“The exciting thing is that they start trekking [traveling] at the beginning and independently of each other in the same direction,” Prins wrote in his 1996 book, *Ecology and Behaviour of the African Buffalo*. “Within seconds, the animals that [start] these movements are followed by other individuals . . . and within about three to five minutes the whole herd of hundreds of individuals moves as if conducted by one master. They totally give the impression that they know where they are going to: Apparently, some decision has been taken by the group.”

Prins realized that multiple cows looking in the same direction becomes a majority vote that seems to decide where the herd will go. No cow ever makes the decision alone, and the same cows do not always decide when to move. Sometimes, however, the cows do disagree. If some cows look one way and too many others look in an opposite direction, the herd might split up. Two groups then might travel to different grazing patches and spend the night. Somehow, cows decide which group to follow. Prins

## AN ANCIENT HERD

In 2007, scientists found evidence that about 120 million years ago, dinosaurs were living in social groups. The scientists discovered the fossils of six young dinosaurs that had been killed together. The young dinosaurs seemed to be part of a dinosaur “nursery.” They were each between 18 months old and 3 years old. Because the babies were different ages, scientists know they were hatched at different times and from different nests. In an interview with BBC News, Paul Barrett, a dinosaur expert with Great Britain’s Natural History Museum, explains, “So one animal came along and laid a set of eggs somewhere, another one laid another set somewhere else—and individuals from each of those clutches came together to form a herd and that’s the first time that we have good evidence of herding behavior in these early dinosaurs.” The young dinosaur group may have made a small herd, but they are proof that living together in a group is an age-old habit.

and other scientists have no idea how this behavior started in African buffalo. They are not sure how it helps the herd to survive, but it seems to work for the African buffalo, and scientists assume it is a valuable survival tool for every individual in the herd.

## A SOCIAL HERD

Herd behavior can be hard to understand. In social herds, behavior may be even more complex. Horses, for example, live in small, well-organized groups. The horses are social and affectionate with one another, and they interact in complicated ways.

A wild horse herd includes one stallion (the male), his harem (several females, or mares), and any young (foals). Usually, a herd

has about 7 to 10 individuals. According to animal expert Desmond Morris, horse society is based on friendships. Although no single individual is dominant all the time, the herd does have leaders and followers. The stallion is dominant when the herd meets other stallions. He allows no grown stallions to come anywhere near his harem. He fights off any stallions that wander too close and drives off the young males in his herd when they are about 18 months old. These young males join bachelor herds. The stallion also works hard to keep his harem together. If they scatter when feeding, for instance, he rounds them up—nipping hindquarters when necessary—and drives them back together.



Horse herds are like family units. Yet, when a stallion becomes too old or weak to fight off a rival stallion, that rival might take his place in the unit.

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This keeps the mares away from any other stallions that might try to steal them.

It seems that the stallion rules by force, but he does not. Much of the time, he is not a leader, but a follower. Morris, in his book, *Horsewatching*, says the stallion is the “hardworking group organizer.” The mares are usually the true leaders of the herd. They decide where and when the herd will move. The stallion follows when the mares are on the move, keeping watch over them and the young. The mares also keep the herd together. Dominant mares will help the stallion round up straying mares. Sometimes the mares will help the stallion drive off intruding stallions. All the horses in the herd seem to want to be together, like a blended family, and they may remain together for years. Only when the stallion becomes too old and weak to fight off a rival will the family break apart. The conquered stallion will go off and join a bachelor herd. Usually, the mares accept the new stallion, and the herd continues as a family unit.

## **HERD BONDING**

Close friendships form within a family of wild horses, usually between two young brothers, two sisters, or a mother and her grown young. Because of these friendships, no individual is dominant in the herd all the time. Two friends may dominate at a food source, other friends may be dominant in deciding where to travel, and the stallion may dominate when a rival is near. Horses are both leaders and followers in their groups.

A wild horse herd maintains its bonds with social behaviors that seem to encourage close friendships. In the heat of the day, when the herd is resting in the shade, horses groom each other with gentle lips and teeth. Friends nibble each other’s backs and manes. Most grooming takes place between friends. The closer

the friendship, the more the two horses groom each other. Also, the entire herd may come together under a tree and brush flies from one another with their tails. Even young foals try to show affection to their mothers. When their mothers groom them, they groom and lick their mothers, too.

Foals love to play. They groom, chase, and play-fight with one another. They play with the stallion, too. He is usually patient with the foals. He tolerates their play and is not aggressive toward them. Mares play only with their own foals, but the stallion seems bonded with all the foals in his herd. His tolerance does not change until the foals are grown. Even then, he accepts the young adult females, although often he ignores them. The young females often leave to find a new herd, so they can mate and have young of their own.

## LEARNING TO BE PART OF THE GROUP

Both play and mutual grooming are survival tactics for the horses. Grooming removes parasites and prevents diseases, such as infections from fly bites. Play is practice for adult group living. Young horses are not born knowing how to behave. They must learn through play and by following the examples of the adults within the group. They learn what to eat, how to avoid predators, how to fight rivals, how to form friendships, and how to be submissive and dominant.

Young horses learn the language of the herd, too, and this helps them to fit into the group. Horses communicate with vocal signals and body language. They have special vocal signals to warn of predators and other dangers. The young learn to run when their elders do. They also give lost calls when they are separated from the group. They neigh to each other in greeting, and squeal to tell each other to stop an unpleasant behavior, such as too-rough play.

## ZEBRAS IN SELFISH HERDS

Zebras live in herds of females and young led by a stallion. The many eyes of the herd help the zebras avoid predators. When zebras are feeding, they constantly scan the environment. Sentinels stand on guard so the rest of the herd can feed in peace. If a lion attacks, the zebras will surround the youngest foals. They will then run away, but slowly, so that the foals can keep up. Meanwhile, the zebra stallion stays behind the herd and attacks the lion with sharp hooves and powerful kicks.

When zebras migrate, they join a selfish herd. Migrating zebras often travel with wildebeest herds. Being part of a huge group means that there are many more eyes to watch for danger. It also reduces each animal's chances of being targeted by a predator. Lions prefer wildebeest to zebras as prey, so zebras that herd with wildebeest reduce those chances even further.



Migrating zebras often travel with wildebeest herds. The larger group can better watch for predators, and lions prefer wildebeest to zebras, giving an advantage to zebras.

Body language signals friendliness, fear, dominance, and submission. Horses may raise their tails high to signal excitement or drop them low in submission. They toss their heads up to indicate dominance or turn their bodies away with heads held low to signal submission and giving in to a dominant animal. When faced with a rival, a stallion may rear or strike out with his front legs, warning the other animal that a fight is possible. Foals learn and practice these behaviors through play. They learn to obey the signals given to them by adults and to be good followers until they are grown. All of the horses use body and vocal language to keep the group functioning smoothly, avoid fights, and maintain their emotional bonds with each other.

## SAFE IN THE HUMAN HERD

Horses are group members that obey leaders, understand submission, and enjoy company and friendships. This makes them fit well within human society. Because horses can cooperate with other group members, they can be tamed by people. People become substitutes for other horses. Horses can make friends with people and like to be with them, just as they do with the members of a wild herd. The same group behaviors that help horses survive in the wild have helped them survive as domesticated animals. People also protect horses from predators and this helps them to survive. Tame horses do not need to band together for defense like buffalo and wildebeest because people are their herds.

Herd animals are prey animals that need some kind of group to survive, but sometimes predators need groups for survival, too. Predators groups are not necessarily for defense. Instead, the groups increase the chances of catching prey.

# 6

## Predator Groups

**CHOP, BOTTOMHOOK, AND LAMDA** heard enticing sounds. The three male bottlenose dolphins raced through the water off Shark Bay at Monkey Mia Research Station in Australia. Porpoising and leaping, they hurried toward the sounds. Rachel Smolker followed them in her small boat. The dolphin researcher had heard nothing, but she was hoping to see what was so exciting. When she caught up with the dolphins, she discovered a feast. But Chop, Bottomhook, and Lamda were not invited. They could only watch and yearn.

### HUNTING WITH FRIENDS

Smolker and the male dolphins had come upon a cooperative dolphin hunting party. Seven female dolphins were “bony banging,” a hunting technique that Smolker named and described in her 2001 book, *To Touch a Wild Dolphin*. The female dolphins were in the midst of a school of bony fish called herring. The dolphins were smacking the water with their tails and gorging on the fish they caught.

No one is sure how bony banging works. In her book, Smolker writes, “It always happened so fast, and when it was close enough to the surface for us to see, all the splashing usually obscured our

view. We just couldn't make out the details." It seems to be a way to kill, stun, or confuse prey. The dolphins may be hitting fish with their tails. They may be creating a wave of water that stuns the fish. They may be confusing the fish with the startling, loud sounds. No matter how it works, the banging seems to be an effective hunting strategy.

The seven females were surrounding the fish school, keeping it corralled, and banging away. Smolker knew these dolphins. They were Crookedfin, Nicky, Puck, Holeyfin, Holly, Joy, and Joysfriend. Crookedfin banged her tail, and a fish went flying into the air. Another dolphin nearby grabbed and ate it. The female dolphins took turns eating the fish that were banged. It seemed to Smolker that the female dolphins were cooperating in a highly social way. Not only did they work together in their hunting, but they also shared the results. This is a remarkably unselfish thing for an animal to do. The seven dolphins often swam together, and apparently that was why they were willing to share food.

The three hungry males were not members of the friendship group, so they were not invited to join in the hunt. The males stayed on the edge of the group, hanging straight down in the water. Their heads were just visible above the water. This position is called snagging. Dolphins do it when they rest. To Smolker, the males looked dejected. She was not sure, of course, what they were thinking or feeling, but she said that they seemed to know that the female group would not share fish with them and would chase them away if they tried to join in. Smolker had seen friendship groups chase away other dolphins that tried to share in their hunting activity many times in the past.

## **SMART, SOCIAL, FRIENDLY**

In dolphin society, groups are divided by gender. Females have groups of female friends, and males have groups of male friends. When it comes to sharing food, dolphins cooperate only with

friends. At least, that is how it appears to dolphin observers. Dolphin society is complex and difficult for observers to understand. Plus, so much happens underwater that learning about dolphin

## HUNTING WITH ECHOLOCATION

Echolocation is how dolphins “see” with sound. A dolphin makes a series of high-speed clicks—sometimes hundreds of clicks per second. These clicks travel through the water in sound waves, which bounce off objects in the water. The sound waves bounce back to the dolphin as echoes. The size and shape of the echoes tell the dolphin the shape of the object and how far away it is.

Dolphins use echolocation for hunting fish. Not only can they find fish with this technique, but they can also confuse the fish with the sounds. Rachel Smolker once observed Holeyfin, Nicky, Puck, Snubnose, and Bibi in a cooperative hunting party near a jetty in the shallows of Shark Bay. A school of bream was hiding by the jetty, where the dolphins could not swim. The dolphins gathered around the jetty, moving their heads back and forth as they echolocated. Smolker listened to these sounds with an under-water microphone. In her book, *To Touch a Wild Dolphin*, she wrote, “The intense buzzing and clicking was deafening, like many electrical appliances shorting out. . . . I can just imagine what it would be like to be the size of a yellow-tail bream and have [dolphins] following me around, vibrating the living daylights out of me with a deafening chainsaw-like buzzer. It would be more than strange. After a while, it could make one crazy and disoriented.”

Apparently, dolphins know that the sounds will bother the fish. Fish, with their lateral line systems, easily feel the sound waves. Exhausted or confused, fish began to break away from the school. That was when the dolphins grabbed them. One by one, all five dolphins got their fish.

groups is a slow process. Scientists, such as Smolker, do know that dolphins form elaborate social networks. Many scientists think that large brains and complex societies go together. The large brains help dolphins cooperate. This increases their chances of surviving to mate and pass on their genes. Friendships are an important part of the survival strategy.

Dolphin friendship groups are called parties. A party usually includes 4 or 5 dolphins, but there can be as few as 2 and as many as 50. Parties change over time. Dolphins live in a fission-fusion society, which means they join and leave parties quite often. Groups break up (fission) and come together (fusion) at different times and with different members. No one knows why dolphins do this, but dolphins seem to have likes and dislikes. Some dolphins avoid other dolphins, and never form parties with them. Other dolphins often spend time together. Although dolphins seem to have no leaders, some may be dominant in parties. The dominant dolphin may decide which way the party will swim, or when to start hunting. Sometimes the dominant dolphin is an older mother. Other times, it is a dolphin with strong, confident behaviors. But no dolphin is dominant all the time.

Many of the dolphins in a large area are familiar with one another. Usually, they all get along. At Shark Bay, for example, about 600 dolphins live in an area of about 77 square miles ( $200 \text{ km}^2$ ). Each dolphin knows at least 60 others. These are the dolphin's associates. Sometimes, when a huge fish school is available, associates will cooperate to herd the fish and ensure a successful hunt. When the feeding is over, however, they reform their smaller parties of friends.

Each dolphin has a signature whistle, and every dolphin knows the whistle of every other dolphin in the same area. Friends, as well as mothers and infants (called calves), find each other by recognizing their whistles. If a stranger enters the area, the resident dolphins greet it. Usually, they are not aggressive,

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but dolphins are not always gentle. In addition to chasing others away from their hunting parties, they may also become aggressive about opportunities for mating.

### MALE ALLIANCES

Male dolphins form groups called **alliances**. These special parties seem to increase the members' chances of mating with females. One alliance typically includes three dolphins. Some alliance members are close relatives, such as brothers, but most are unrelated. Chop, Bottomhook, and Lamda were an alliance. They swam together, foraged together, and helped each other in disputes with other alliances.

When a female dolphin is ready to mate, an alliance captures her and keeps her for days or weeks. Alliance members fight off other dolphins that try to steal the female. Observers believe that this behavior helps males to pass on their genes. Alone, one male dolphin could never keep a female to himself or fight off other dolphins. Yet, a group of three males can corral a female and fight off other male efforts to mate with her. The dolphins in an alliance seem to stand a better chance of mating and passing on their genes. Until, that is, a super alliance forms.

Dolphins are brainy enough to figure out that sometimes more is better. Alliances can persuade other alliances to join them in their quest to steal females. Three or more alliances may join together in a super alliance. Richard Connor, an observer with Smolker at Shark Bay, discovered one super alliance that had 14 males in it. This super alliance could defeat every other alliance in the area. The males cooperated to steal females from other alliances. To defend themselves against this super alliance, other male groups had to team up with one another. These alliance teams are not tightly bonded. Once the fight for

a female is over, the team breaks up into alliances again. The dolphins remain friendly with one another, but they are not close friends.

## TIGHTENING SOCIAL BONDS

The males in an alliance seem not only bonded, but also dependent on one another. They may stay together for up to 20 years, although the alliance may merge with and separate from other male alliances or male friends over the years. Dolphin



Mother dolphins and their young have a tight bond. The young are dependent on their mothers until they are at least three years old, and they learn a lot in play time with other mothers and young in their party.

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researchers think the males are expressing affection for one another when they “hold hands” using their fins. It appears to be some kind of bonding behavior anyway. They also pet and stroke each other with fins and mouths. They rub against each other. Females and young in parties do the same thing. They play together frequently, chasing each other, playing keep-away with a hunk of seaweed, or just splashing and rolling around. With their play, the young begin to form friendships and alliances with other calves that may last a lifetime.

Young dolphins grow up slowly. They must learn many skills to survive. Living and playing in a group helps them do this. They imitate their mothers and practice foraging for fish when they are about six months old, but they remain dependent on their mothers and their mothers’ milk until they are at least three years old. During this time, other female dolphins may act as escorts and protectors for a baby while its mother forages.

In its first year of life, the young dolphin develops its signature whistle, which it learns by imitating the dolphins in its party. Although the whistle is learned by imitation, each whistle is slightly different from that of every other dolphin. It is unique and is the dolphin’s “nametag,” according to zoologists. There is some evidence, says Connor, that the signature whistle for a male dolphin will change when it grows up and forms an alliance. The whistles of the dolphins within an alliance seem to be similar. The adult males seem to be imitating the dolphins in the alliance rather than retaining the whistles they learned as infants by imitating their mothers. Scientists believe having similar whistles is a way the dolphins bond with one another or perhaps a way they express that bond. As the dolphins change their whistles to match the alliance or friendship group, they are perhaps signaling their “belonging-ness” within the group.

## LEARNING TRADITIONS

The learning that takes place in dolphin society can also be seen in the way young dolphins learn to use tools. Sponging is a foraging technique taught to daughters by their mothers in one extended family of the Monkey Mia dolphins. Smolker discovered this hunting technique. It is the first known case of learned tool-use in a dolphin society. A sponging dolphin puts a sea sponge on her rostrum, or beak. Then she cruises along the ocean floor looking for fish. No one is sure how sponging helps in foraging, but observers think it may protect the dolphin's delicate beak from being scraped by rocks and sand. It also may protect it from the spines and poisons of certain bottom-dwelling fish.

Since 1984, Shark Bay observers have studied the spongers. By 2007, they had identified around 24 sponge-carrying dolphins. Almost all of them are female and most are the daughters of spongers. One male (the son of a sponging mother) foraged with a sponge on his beak. Connor and other scientists believe sponging started with one female dolphin and then was imitated by her daughters and granddaughters. It is a learned behavior, but rarely copied by male dolphins. Males may not sponge because they join alliances and imitate one another, rather than their mothers. Friendships, alliances, and imitation are vital components of dolphin society. The social attachments encourage cooperation and learning and increase the odds that the dolphins will survive to pass on their genes. The dolphins' intelligence makes their social relationships possible. Dolphin society and all its related behaviors are an important strategy for survival.

## SOCIAL LIFE IN THE WOLF PACK

Social attachments are important survival strategies for predator groups on land, as well. Scientists believe that intelligence makes

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these relationships possible. Many believe that only as animals' intelligence evolves does it become possible for them to use social groups to survive.

Wolf pack societies are some of the most studied social groups. Like dolphin groups, wolf packs demonstrate how social attachments help groups cooperate, organize themselves, and survive. However, wolves have a different social structure than dolphins do.

Wolves live in family groups with strict dominance hierarchies. An alpha pair leads the pack. The other pack members are the alpha pair's grown offspring and the newest pups. The alpha



Disputes in the social wolf pack are resolved with displays of dominance and submission. Here, a higher-ranking wolf displays dominant body language and a snarled warning. The lower-ranking wolf submits by rolling onto its back and tucking in its tail.

wolves are the only ones to mate and have pups. Each member of the group has a rank, from the alpha pair, to the next highest beta animal, all the way down to the omega wolf. The omega wolf submits, or gives in, to all the other wolves.

Each wolf knows its place in the pack and can change its rank only by fighting the animal above it. Usually, the hierarchy keeps the group stable by preventing fights and aggression. It also helps the wolves hunt as a group and bring down prey that no wolf could kill by itself.

The alpha wolves lead the hunt. They are the oldest and most experienced. Following the cues from the alphas, the hunting wolves identify, encircle, and attack prey, such as deer or bison. With a successful kill, all the animals share in the meat, but not equally. The alpha wolves eat first, and the omega wolf eats last. If the alpha female is in the den with newborn pups, the other wolves will bring back meat for her. It is unusual for animals to share food, but predator groups often do. Scientists believe food sharing helps wolves successfully raise young and pass on their genes to the next generation. Because the pack is a family, helping the pups to survive benefits the whole pack. Each wolf has genes in common with the pups.

When pups get older, the mother leaves them in the care of the omega wolf while she joins the hunt. Successful hunters regurgitate some of their meat for the pups and omega wolf. All wolves in the pack feed, play with, and care for the pups. Almost from birth, wolves are dependent on their packs. Wolves do not like to be alone. They greet one another after they have been separated. Although fights do occur, wolves seem to submit easily to dominant individuals and are highly social, cooperative members of their packs. When they are threatened by danger, such as an attacking bear, they will fight as one and even give their lives in defense of the pack.

## FROM WOLF PACK TO HUMAN PACK

Domestic dogs are descended from wolves. It may be the similarity of human groups and wolf packs that has turned dogs into “man’s best friends.” Both humans and wolves express affection in mutually understandable ways. Both communicate using body language and vocal signals. Wolves use their brains to follow and obey leaders. They are naturally eager to please dominant individuals. Dogs still need to belong to a pack, and often that pack is a human family.

Humans are intelligent, big-brained animals that live in social groups, too. People also depend on relationships, cooperation, and hierarchies (parental authority, government, or bosses, for instance) for survival. Humans are primates, and their closest relatives—the non-human primates—are some of the most social animals on Earth. They live in social groups that may offer clues about how human social groupings came to be.

## Primate Societies

**WHEN SHIRLEY STRUM** first met the Pumphouse Gang, a group of olive baboons, she expected it to be a brutal, aggressive society. She expected a strict hierarchy, like a wolf pack, ruled by male dominance and fights for dominance. The 60 olive baboons in the troop taught her otherwise. The Pumphouse Gang was more like a human society than Strum had ever imagined. In fact, when Strum wrote a book about olive baboon society, she titled it *Almost Human*.

Strum discovered that baboons organize themselves as people do. They have leaders and rules about how to behave. They form strong bonds with one another. They use their brains to get along.

Within the troop, baboons learn from other baboons. They learn how to fight and how to stick together. They learn where and how to find food. They learn which animals are their enemies, and how to communicate with other baboons.

Strum learned about baboon society through years of careful observation of the Pumphouse Gang. She identified each troop member, gave each one a name, and then took notes about each one's personality. She watched the complicated ways in which the baboons related to one another. Her discovery of a complex,

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cooperative baboon society is not unique among primates. Jane Goodall discovered the same kind of complexities in chimpanzees, as did Dian Fossey in gorillas.

Among these primates, aggression is a part of their societies, but it is not the most important part. Peaceful interactions and emotional bonds keep groups together. These animals can learn from experience and change their behaviors to adapt to new events. This helps them to survive.

### **PEGGY AND FAMILY**

At its core, baboon society is dependent on a stable group of mothers. It is a matrilineal society, similar to elephant society, but baboons also have a dominance hierarchy. Each adult female has a rank. Males come and go in the troop, and there are only a few males at any one time. Females do not try to dominate males, who are much larger and stronger.

The Pumphouse Gang consisted of 6 adult males, 17 adult females, and 37 youngsters. The young baboons ranged from infants to “teenagers,” or subadults. Females are considered adults after about age 6; males are adult after about age 10.

Peggy was the dominant female. All of her children, grown or immature, shared her rank. She would support them in any dispute with other troop members. She did not outrank any adult males, but she could dominate any female or young baboon. Peggy’s family included her adult daughter, Thea, and Thea’s three youngsters; Peggy’s subadult son, Paul; her juvenile son, Patrick; and her infant daughter, Pebbles.

The members of Peggy’s large family rested, foraged for food, and played together. They also supported one another against other baboons. One of them would usually get the best food or resting spot, or win a squabble with a baboon from another family. If Patrick was playing with an older juvenile who got too rough and hurt him, he would squeal, and Peggy would



Baboon society depends upon both family and friendship ties. Here, a group of olive baboons of various ages relaxes together while an infant tries to get the attention of an adult.

come running. Often, the other baboon would run away with just a look from Peggy. If Peggy got into a fight about a resting spot in the shade, Paul would come running to help her win. Because he was already larger than the females, he did not have to be very aggressive to help his mother. Members of an extended family such as Peggy's depend on and defend one another in almost every situation.

### The Importance of Friends

Family is most important to baboons, but friendships are important, too. Peggy's good friend was Constance, another female baboon about the same age. They often sat together and

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fed together. Their infants played with each other. Peggy may have been dominant, but she was not aggressive toward Constance. Peggy had a calm, social personality and seemed to treat Constance as a true companion. Unless Peggy's family was involved, she would support Constance if another baboon tried to bully her. Being Peggy's friend had a lot of advantages for troop members, including the baboon males.

Male baboons usually leave their home troops when they are adults or subadults. They search for a new troop to join, but acceptance can be difficult. Ray, an adult male baboon, joined the Pumphouse Gang gradually, proving he was not a threat. Day after day, he sat outside the group, not bothering anyone. Eventually, he edged in closer and tried to make friends. At first, the other baboons acted afraid of him, but Ray persisted. He was never aggressive and did not fight with the other adult males for a place in the troop, as Strum expected him to do. Instead, he cautiously worked his way in and eventually tried to make friends with Peggy.

Peggy already had a male friend named Sumner. Female baboons often have male friends, and the relationship benefits both individuals. Male friends support and protect females in arguments, or when other males bully them. They also act like godfathers, playing with and protecting a female friend's infant. Sumner was Pebbles's personal jungle gym. A special male friend is valuable to any female, and because she is comfortable with him, he is often the baboon who gets to mate with her when she is ready. The friendship makes it likely that the male baboon will father her babies and pass on his genes.

## **KEEPING ONE'S FRIENDS**

Jealousy over female special friends can cause aggression between males. Sumner was not happy when Ray tried to befriend

## KEEPING THE GROUP GENETICALLY HEALTHY

**When adult animals remain with their families, they have no one to mate with except close relatives. Mating between close relatives is called inbreeding. If inbreeding happens often enough, the infants are more likely to have birth defects. All animals have mistakes in some of their genes. But relatives' genes are more likely to include the same mistakes. So if relatives mate, their infant could get two copies of a "mistake." This can lead to disability or weakness in the infant, or even cause an infant to die prematurely.**

**Most animal groups have an innate technique to prevent inbreeding. In baboons, young males leave their family troop and search for a new one. In gorillas, young female adults join new groups. Chimpanzees move easily among different groups. Yet, the animals do not move because they "know" that it is unhealthy to mate with close relatives. Young adults simply have the urge to move out of their birth troops. No one really knows what motivates them to do this, but those animals that change groups are likely to produce the healthiest young, and pass on their genes to the next generation. They also pass on the urge to leave the family troop. Those animals that breed with close relatives produce weak young with less chance of survival. Over time, the genes that drive animals to change troops become much more common.**

Peggy. At first, Sumner ignored Ray, as did the other Pumphouse Gang males. However, Sumner was frightened by Ray's interest in Peggy. He tried to keep her away from Ray. After threatening each other and trying to bluff each other with aggressive faces and chases, Sumner and Ray fought. In *Almost Human*,

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Strum writes, “The two males grappled, circling each other, pant-grunting. Sumner screamed—an adult male scream is a serious expression of fear—and it was all over as suddenly as it had begun. Neither male was hurt, and I couldn’t tell who’d won.” Both males walked away from Peggy, and Strum remembered, “I found myself stunned and shaking.” The fight had seemed frightening and vicious, but life went back to normal. Ray had a place



Aggression between male baboons can be caused by jealousy over female special friends.

in the troop. He did not become Peggy's special friend, but he did make friends with other females and their youngsters.

Friendships keep baboon society running smoothly and peacefully. Within a troop, grooming strengthens friendships and bonds. When the troop is resting, family members and friends groom one another. Infants even try to groom their adult male friends. Tension is eased by grooming. Aggression is avoided when one baboon offers to groom another. Strum calls grooming "the monkey equivalent of a good massage." Peggy seemed to love to groom Sumner. Sumner was friends with Constance, too. He often stretched out and looked relaxed as he was groomed by his female friends or played with their infants.

## THE MALE WORLD

Adult male baboons do not seem to form close friendships with one another. They will, however, form temporary partnerships, or alliances. Males compete with each other for dominance. Mostly, their competition takes the form of bluffs with threatening body language, angry sounds, and fake attacks. Newcomers to the troop seem to act more aggressively than longtime resident males do. They may be trying to force the other males to accept them. A male may threaten another male for several reasons. He may want to make another male submit to him, run away, or get away from a female. If the male cannot threaten his rival by himself, he will approach a third male and signal for help. One day, Ray tried to bluff both Sumner and Big Sam, a powerful longtime resident of the Pumphouse Gang. Ray failed, but he did not yet know any males well enough to ask for help. Instead, he asked a human. He rushed toward Strum, who was observing the troop. He slapped his hand on the ground, stared right at her, and then stared at the two males. Clearly, Strum thought, he was asking for an alliance. Two male baboons can usually win

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against one baboon, no matter how powerful, and they have a good chance against two baboons. Strum could not help Ray, of course, so she turned her back to him. This is the way baboons ignore one another and reject requests.

Eventually, Ray made a place for himself in the troop, and became less competitive. Strum was surprised to discover that newcomers depended on fights and aggression, while the most powerful troop males did not. To her, it seemed that newcomers were dominant. As each newcomer made a place for himself, he became social, non-aggressive, and submissive to other dominant, aggressive newcomers. But the dominant males were not the most successful. It was the social baboons who had the most friends, got groomed, had plenty of time for foraging, and had the best chances for mating and passing on their genes.

## **A DIFFERENT KIND OF TROOP**

Comfortable, relaxed adult males are important to baboon society because of the protection their friendships provide for all the troop's members. Within a troop, the males break up squabbles and help care for the young. They help keep the society peaceful. When researcher Robert Sapolsky was observing a different baboon troop in another part of Africa, he discovered that individual personalities can shape the culture of a troop. In his book, *A Primate's Memoir*, Sapolsky writes about the day when a baboon named Nick decided to join the troop that Sapolsky was watching. Nick was aggressive, but he was also smart and strong. He quickly became the alpha male. He dominated and bullied the other baboons. The baboons in Sapolsky's troop became stressed and timid, different from the calm, friendly animals in the Pumphouse Gang.

Despite Nick's brutal leadership, affiliations and friendships still counted most in the baboon troop. Sapolsky observed the

## ORANGUTANS

Orangutans are primates that do not live in social groups. They live alone, probably because the treetop fruit and vegetation they eat is never abundant in their rain forest homes. Like group-living primates, orangutans depend on learning for survival. They have long childhoods, during which they are dependent on their mothers. Females may stay with their mothers until they are teenagers. They watch how their mothers care for infants and learn to become good mothers themselves. A mother and her youngsters develop deep social and emotional bonds throughout the years they are together.

At the Nyaru Menteng Orangutan Rehabilitation Center in the wilds of Borneo, researchers Lone Droscher-Nielsen and Willie Smits are currently studying whether 35 young

*(continues)*



Orangutans do not live in social groups, but mothers and their young develop deep bonds. Here, a baby orangutan sits with its mother.

*(continued)*

**orphaned orangutans can live in a group. The orphans live on a small island together. There is not enough room for them to live solitary lives. The orangutans play together, groom one another, and seem to form bonds. No one knows whether this human-made community will last when the orangutans become adults.**

troop on the move when it came too close to a sleeping female lion. Lions prey on baboons, and the troop was terrified. They ran screaming for the trees, where the adult males made loud, excited “wa-hoo” noises. Two one-year-old infants didn’t make it to the trees. As the lion crept toward them, it was not Nick who tried to help. Instead, an adult male friend named Benjamin courageously raced to place himself between the lion and the endangered babies. Sapolsky reports, “The lion approaches, Benjamin begins snarling and lunging, canines bared. . . . And it’s working. The lion stops, now about five feet away, flinching each time Benjamin lunges. She tenses for a spring, lifts a paw . . . and paws at the ground a second and then walks off.” The babies were saved.

## **AMONG THE CHIMPANZEES**

Cooperation in a complex society, say primatologists, is the most important survival strategy for primates. Chimpanzee societies are even more complex and cooperative than baboon societies.

Like dolphins, chimps live in fission-fusion societies. Each group may include 60 or more chimpanzees. Within this community, the chimps gather into small troops of about six members

to feed or socialize. The members of the troops know one another, and the membership of any one troop can change frequently. When one troop meets another in a baboon society, there is likely to be some aggression or suspicion and nervousness. Chimps, however, greet one another with gestures of friendship and seem excited to be together. Troops will often keep in contact with each other by making a sound called a “pant-hoot.” When the troops come together, they may re-form with different members. Females may change troops to look for mates. Males may change troops to form hunting parties. Their hunts help the whole society to survive.



Like humans, chimpanzees show love and sympathy for one another. It appears to be part of their genetic makeup.

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Non-human primates do eat meat, although they are mostly vegetarian. Baboons love meat, but because they do not hunt together, they rarely eat it. Usually, a baboon gets meat by stumbling across small prey by accident. Chimps, on the other hand, organize hunting parties and work as a team. A hunting party may be as large as 35 adult males, adult females, and adolescents. They stalk small monkeys, for instance, and encircle the prey. A group of chimps arrange themselves to cut off escape routes, while another chimp sneaks up behind the monkey and grabs it. A large party can catch many monkeys, and all the hunters share in the kills.

Whether it's meat or vegetation, chimps will share their food with friends and family. A hungry chimp will make begging gestures. If the feeding chimp is bonded with the hungry one, he or she will offer a portion of the food. Chimps are most likely to share with those who have shared with them in the past, and those who groom them frequently. Survival in a chimp community seems based on **reciprocal** behavior. Chimps remember who has helped them in the past, and seem to know that their generosity will be repaid in the future. The most cooperative and helpful chimps get the most benefit from the community. Sharing appears unselfish, but reciprocal behavior is a selfish, long-term strategy that helps each chimp's genes survive.

## LOVING EACH OTHER

Emotions, and even sympathy, are important parts of chimpanzee life. Chimps not only groom each other, but also kiss, hug, and pet each other. They offer comfort and concern when another chimp is hurt. Within a community, males have a dominance hierarchy, and sometimes fights break out over rank and status. If two males have a fight but fail to "make up" afterward,



Chimpanzees in Uganda use sticks as tools to fish termites out of the mound the insects created as a safe home.

females will bring the two males together and seem to persuade them to be friends again. Mothers reassure and pat frightened infants. According to Jane Goodall and other observers, chimps truly love each other. Goodall tells about an eight-year-old male named Flint who was overwhelmed with grief when his mother died, even though he was not dependent on her anymore. Flint stopped eating, refused to have anything to do with his friends, and sank into depression. He was so uninterested in living that he got sick and died a month later. The other chimps could not console Flint, but when juvenile chimps are orphaned, older chimps will adopt them and care for them.

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The ability to love and sympathize with others is probably a part of the chimpanzee's genetic makeup. It is encouraged and nourished by the learning that takes place in the community. Chimps are intelligent. They spend their long childhoods learning to get along in their society. They play with one another, learn to communicate, and copy adult behavior. Young chimps learn how to make and use tools. They may put a cleaned twig into a termite mound to get termites, or jab a sharp stick into a hole to catch a small animal. Young chimps are guarded from danger, taught to fear predators, and encouraged to be independent as they get older. All of this protection and teaching gives young chimps their best chance to survive. It increases the odds that their genes will be passed on to future generations. Though chimps can be aggressive—and even attack other chimp communities in warlike raids—scientists believe it is the positive emotions within a community that make chimp society successful.

## **BEYOND THEIR CONTROL**

Chimpanzees, however, are at risk of not surviving at all. No matter how successful their societies are, they live in a world where other primates—human beings—threaten their survival. Humans kill chimps illegally (in an act called poaching) and destroy their forest homes. No animal group lives in isolation, and each group is affected by its larger environment.

# 8

## Ecology and Groups

**ECOLOGY IS THE STUDY** of how living things get along in the environment. Every animal group must interact with other living things, and those interactions have positive and negative consequences.

### TREASURE FROM THE OUTSIDERS

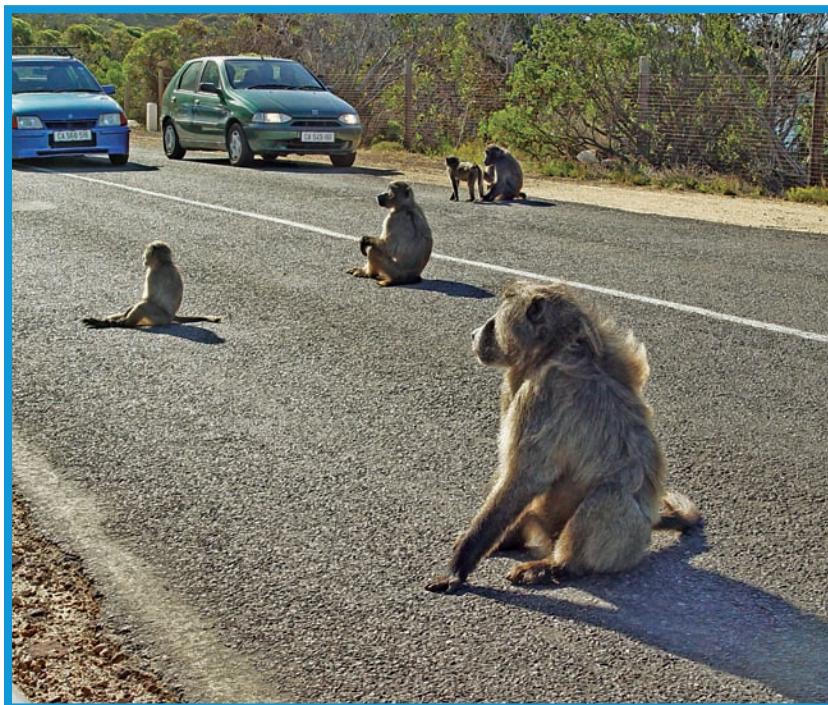
Humans live in complex social groups, just as chimps and baboons do. When human groups—such as groups of people from local villages or tourist or researcher camps—come into contact with baboons, the results may both harm and help the animals.

The baboons of the Pumphouse Gang lived on a savanna, where other baboon troops claimed territories as well. Although the troops lived in the wild, human groups began making changes in this area soon after Strum started observing the baboons. She named one neighboring troop Cripple Troop because so many of its members were injured. Their injuries seemed to come from accidental contact with the electrical wires that people strung through the territory. Then, a few years later, the military built an army base, complete with housing for families and a large aboveground garbage dump. Gradually, the baboons of Cripple Troop discovered that the

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garbage dump was a rich feasting ground. More baboons came to the garbage dump to feed. Finding food there was so much easier than searching for it in the wild, and there was a lot of it. The Cripple Troop baboons could laze around most of the day instead of foraging for hours. Young males from other troops, including the Pumphouse Gang, started joining Cripple Troop baboons and living the easy life.

At first, the people at the army base either ignored or enjoyed the baboons. Many of the people were from the city and had never seen wildlife. They began offering food to baboons that came into their yards. The baboons lost their fear of people



When human and baboon societies become mixed, it can mean danger for baboons. These baboons in South Africa are causing a traffic jam.

and began raiding houses. Baboons would break in through doors and windows and steal food from kitchens and storerooms. Next, farmers moved into the area and planted crops. Crop raiding became a favorite activity in the baboon troops, especially for the young adults and adolescents. They were quick to learning new foraging techniques and determined to take advantage of the human groups who had invaded their territory.

The human society's takeover of the baboons' territory had a powerful effect on the baboons. The troops lost territory for foraging, but they made up for it with the rich food they got from the dump and from crop raiding. Strum sometimes saw baboons leaving a field with armloads of stolen corn. The baboons that ate the human food grew stronger and healthier than those who were hesitant to raid. Their coats were visibly thicker and shinier. The females were so much healthier that they began having babies more often. It seemed that the human invasion did great things for the baboon society. The advantages, however, were temporary.

Farmers and military officials became angry at the destruction that the baboons caused. The farmers were poor and couldn't afford to have their crops stolen. They put up fences and got guard dogs, but the baboons tore up the fences and killed two dogs that tried to attack them. The humans began to see the baboons as pests. Baboons were shot, and the very survival of the troops was at risk. The only way Strum was able to protect the baboons from being wiped out was to relocate them to another part of Kenya where people did not live. In the end, the interaction between the two primate groups (human and baboon) could have meant death for all the baboons.

## **BALANCE OF POWER**

Human societies are so powerful that they can change the environment completely. However, when humans are out of the

picture, ecological systems are in balance. Group living brings both advantages and disadvantages for each group in a system. Predator groups such as lions, for instance, could not survive without herds of wildebeest. The births of lion cubs occur at the same time as the wildebeest migration. Hungry female lions gorge on wildebeest. They are then strong enough to produce plenty of milk so their cubs can survive. Wildebeest lose their lives, but usually it is the weakest ones that die. The strongest

## **ECOTOURISM AND THE MOUNTAIN GORILLA**

**The mountain gorillas that live in one area of Rwanda are some of the most endangered animals on Earth. Mountain gorillas live in family groups. They are led by a dominant male. He is called the silverback because of the silver-colored mantle of fur on his back. Typically, three adult females make up the core of the family. The rest of the group may consist of infants, juveniles, subadults, and black-backed males that are not old enough to lead their own groups. The gorillas are gentle. They cannot protect themselves from humans. When people move in and begin to farm and destroy the forest, the gorillas have no place to go. Poachers destroy gorilla families by killing silverbacks to sell their heads and hands to collectors, or by stealing their infants to sell. Hunters move into gorilla territory and set wire noose traps. Gorillas are maimed and killed when they stumble into the traps.**

**In 1979, researchers Amy Vedder and Bill Weber began the Mountain Gorilla Project in an effort to save the mountain gorillas. Weber and Vedder believed that if the Rwandan people saw the value of gorillas, they would protect them instead of harming them and taking their land. They hoped that Rwandans could earn money through ecotourism.**

wildebeest calves get to their feet and run immediately after birth, and they are the ones that survive to pass on their genes. The health of the wildebeest herd is increased when the weaker calves are killed. The predators actually help the herd become stronger. Both predators and prey benefit.

Animal groups can be a valuable and necessary part of the ecological system. Even plants may be dependent on the activities of an animal group. Elephant herds, for example, eat a huge

**When tourists travel to natural environments to appreciate and enjoy the wildlife, it is called ecotourism. Ecotourism benefits the local human population while helping to conserve wildlife and wild places. The Mountain Gorilla Project set up a plan so that small groups of tourists could hike into the park where the gorillas lived. They were led by local guides to see the gorillas. The plan was a success for both humans and gorillas. The gorillas even seemed to cooperate. One group of gorillas was carefully habituated to the presence of people. The gorilla family started taking a rest break when tourists approached. They would sit in a clearing where the visitors could see them. If the tour group showed up early in the morning, the gorillas rested then. If the group did not appear until noon, the gorillas waited to rest until the humans appeared.**

**Tourists were thrilled by the opportunity to visit gorillas in the wild. Local people made money by guiding the tourists. After 10 years, the population of mountain gorillas had increased from 239 to 324. Political problems and a terrible civil war during the 1990s caused problems for ecotourism, but the gorillas did not die out. In 2004, the International Gorilla Conservation Program (which took over for the Mountain Gorilla Project) counted 380 mountain gorillas.**

amount of vegetation each day. At first glance, their activity looks destructive. They kill trees by tearing off branches, stripping off bark, and even uprooting young trees. They strip other trees of their fruit, leaving nothing for other animals. One tree, however, depends on the elephants for survival. *Balanites wilsoniana* is a fruit tree that grows in African forests. When the seeds in its fruit drop to the ground, they rarely sprout and grow into new trees. Animals eat some seeds. Many more die without sprouting. Elephants make all the difference. When elephants eat the fruits, they pass many seeds in their dung, or bodily waste. These seeds are dropped far away from the trees from which they came, as the elephants travel from place to place. These seeds are much more likely to sprout. The trees that grow from these seeds are stronger and grow taller than other seeds, too. According to scientist Erica Paige Cochrane, *Balanites wilsoniana* needs elephants to survive.

Elephant groups affect the environment in another way when they kill trees. They help to develop savannas, or open grasslands. Over time, this change provides an environment in which many other animals can find food and thrive.

## GROUP VICTIMS

Animal groups interact with another part of the ecological system, too. Unfortunately, this interaction can be devastating for the animals. Bacteria, viruses, and parasites find animal groups to be ideal environments to ensure their own survival. They take advantage of the close contact among group members to pass on their own genes. The group makes it easy for germs and parasites to spread, reproduce, and thrive. In some cases, group-living animals have evolved ways to fight back. In others, the survival of the animals is at risk.

The chalkwood fungus, for example, can infect honeybee hives, thereby killing the larvae. The honeybees seem to instinctively recognize this problem. When the bees detect the fungus, nursemaid bees heat the hive by rapidly beating their wings. The extra heat often kills the fungus and saves the hive.

In 2006, however, honeybee hives in the United States and other countries began dying, and no one knew why. Entire hives would die out as all the worker bees disappeared. If the queen and larvae were left alive, they soon died of starvation. No one could even find the bodies of the worker bees. Scientists suspected a disease, but they did not know for sure. In the past, almost all of the wild honeybee hives in America had been wiped out because of a mite. This is a tiny parasite somewhat like a tick. It sucked a bee's blood and also carried fatal diseases. Now, honeybees raised by beekeepers were dying out, too. Whatever was killing the bees moved rapidly. By 2008, scientists still did not know what was killing the hives, but studies suggested it was a new virus. American bees are in real danger. Success for the virus may mean death for honeybees. In the bees' situation, group living has been an advantage for the virus and a disadvantage for the hives.

## **STEALTH ATTACKS ON TWO GROUPS**

Typically, diseases do not kill whole groups. Yet, parasites usually kill some group members every year. Parasites survive by feeding off other living things. A parasite's host may lose the benefits of group living.

A tiny flatworm called a trematode is a parasite in some fish, such as bass and minnows. The worm bores into a fish's skin, and black spots form on the fish. Other fish in the school or shoal notice the spots and will not swim with the infected fish. The fish ends up alone, or at the very edge of the school. It no longer



A kingfisher that eats a fish infected with parasites will release the parasite's eggs through its droppings, allowing the cycle of infection to continue in the fish's family.

has the group for protection. If all goes right for the parasite, birds called kingfishers see the diseased fish. The kingfishers eat the fish and the worms. Inside the kingfishers, the worms grow to adulthood and lay eggs. The eggs fall back into the water in kingfisher droppings. They hatch into tiny worms that infect more fish. This system is successful for the worm, but for any infected fish, it is a genetic dead end. The system is destructive for kingfishers, too. Baby kingfishers that eat infected fish end up with parasites inside them. They are smaller and grow more

slowly than healthy kingfishers. Often, the young birds do not live to pass on their genes.

## **LOSING THE GROUP ADVANTAGE**

Many eyes cannot protect a group when the attacker is too small to be seen. Neither cooperation nor social and emotional bonds can keep a group whole when disease strikes. In 1966, the chimps that researcher Jane Goodall was observing faced an outbreak of polio. Some chimps in the community died, especially young ones, and many others were permanently paralyzed. Although the community eventually recovered, individual chimps suffered, and some were even rejected by the group because their movements were too different and frightening.

Researcher Robert Sapolsky watched an epidemic of tuberculosis race through his baboon troop. The baboons did not infect one another. The disease started in a neighboring troop that lived near a human garbage dump. More than 70% of this troop was infected. They acquired the germs by eating discarded scraps of infected cattle that were butchered at a nearby hotel for its restaurant kitchen. Members of the troop that Sapolsky was observing then began following the neighboring troop to the garbage dump. They were infected, too. They led other troop members to the food. Many animals died. The baboons' friendships and social ties made it easy to learn to eat food at the dump, but they could not defend themselves against tuberculosis.

## **FIGHTING BACK**

The spread of disease is sometimes a disadvantage of group living, but at other times being part of a group actually helps prevent disease. Social baboons in troops, for instance, have very

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few parasites. Their bodies and hair are usually clean, because the baboons groom each other so often. Grooming is a social activity and a strategy for maintaining good health. Friends groom the body parts that an individual cannot reach. Diseases caused by parasites are unlikely in a friendly, cooperative troop.

Horses in herds help one another get rid of pests, too. They have fewer horseflies and bites on their skin than horses that live alone. The horses swish away flies from one another with their tails, and the health of the entire herd is improved. Scientists say that the benefits of group living usually outweigh the risks, but diseases can be a damaging outcome of group living.

## **WITH THE HELP OF ANIMAL GROUPS**

Social humans have faced the same kinds of problems as other animal groups. Plagues and epidemics have sometimes been so widespread that the survival of human groups has been in doubt. Yet, people learned to help one another survive contacts with germs and parasites. Interacting with other kinds of animal groups may have been a big advantage for the primates that evolved into human beings. Early in history, say ethologists, these primates had to cooperate with one another to kill herd animals for food and to protect themselves from dangerous predators. The need to cooperate for hunting and to escape danger may have led to language development. Language helped them communicate with one another. The proto-humans had to learn social skills and unselfishness so that the group would benefit from the food they hunted. These skills may have demanded larger brains and more intelligence. As they got smarter and more cooperative, the proto-humans became more successful. Because of their interactions with the animal groups they feared and hunted, they evolved and became brainy, cooperative human animals.

Modern human culture and progress may be a direct result of humanity's interaction with animal groups. Long ago, many people stopped roaming, hunting, and foraging as other primates do. They settled down in villages. This was possible because they became herders of animals, such as sheep, goats, and cattle.

Because these animals were social animals that lived in groups, people could tame and herd them. When people learned to live off the animals they raised, their societies were changed forever. Food supplies were drastically increased. People began growing crops, which provided even richer sources of food. Human societies were revolutionized. The ascent to complicated societies and the advance of civilization had begun. Perhaps, say some scientists, the pressure of competing with and learning to use other animals in groups is what made humans the smartest, most powerful primates. Maybe people have animal groups to thank for their success on Earth.

# Glossary

**Alliances** Partnerships in which two or more individuals cooperate for mutual benefit

**Alpha** The individual with the highest rank in a group hierarchy; the “top dog”

**Altruistic** Acting to benefit another animal. Altruistic behavior seems unselfish, and may result in harm to the individual.

**Dominant** In the top position and with the most influence and control over other individuals in the group

**Foraging** Searching for food

**Gene** A specific length of DNA that provides the chemical code for a protein

**Gregarious** Social, friendly

**Grooming** The cleaning of the body by licking, nibbling, picking, and so on. Grooming is both a social activity and a way to remove dirt and parasites.

**Hierarchy** A social system with layers of organization such that each individual controls the individuals below it in the “pecking order” and is controlled by those above it

**Innate** Existing in or determined by factors present in an individual from birth

**Juvenile** Child; older than an infant but not yet adolescent

**Larvae** The newly hatched, wingless, worm-like forms of many insects

**Many Eyes** An advantage of group living that describes the increased ability to detect danger due to the watchfulness of many individuals

**Mobbing** A group attack on a predator that is too dangerous for one individual to handle alone. The predator may be hurt, killed, or just driven away.

**Predator** An animal that hunts other animals for food

**Pupae** Developing insects inside cocoons. The life stages of some insects in which they undergo transformation from larvae to adults.

**Reciprocal** Referring to the trading of beneficial activities or behaviors between two or more individuals at different times—“You scratch my back, I’ll scratch yours.”

**Selfish herd** A group of animals in which each individual increases its own chance of survival simply by being part of a large group and thus reducing the chance that it will become prey. Individuals in selfish herds are not assumed to be bonded with each other or to care about each other.

**Society** A group of individuals organized in a cooperative way

**Species** A basic category of animals that are so closely related biologically that they can mate and breed with one another

**Status** Relative standing or position within a society

**Submissive** Giving in or yielding to the demands of others. An animal of low status or social position submits to, or obeys, an animal of higher rank.

**Synchrony** The coordinated timing of movement among many individuals so that they travel or move as one

**You first!** An advantage of group living that refers to the odds that an individual will not be a predator’s target. This is also called the dilution (or decreasing) of risk. Another individual is likely to be attacked because the group is so large and visually confusing. Each individual in a large group benefits from this advantage.

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## **WEB SITES**

### **The Dian Fossey Gorilla Fund International (DFGFI)**

<http://www.gorillafund.org/index.php>

This Web site is dedicated to continuing the work of Dian Fossey to save the mountain gorilla in Rwanda and Congo. Visitors can learn about conservation efforts, as well as gorilla behavior.

### **Dolphins of Monkey Mia Research Foundation**

<http://www.monkeymiadolphins.org/>

Click on the links to see slide shows of the various dolphins at Monkey Mia and to read about the latest findings in dolphin research.

### **Frame, George and Lory, "Wildebeests on the Move," Highlights for Kids**

[http://www.highlightskids.com/Science/Stories/SS0895\\_wildebeests.asp](http://www.highlightskids.com/Science/Stories/SS0895_wildebeests.asp)

Two observers describe their experience of watching a wildebeest migration on the Serengeti Plain.

### **Insecta Inspecta World: Army Ants**

<http://www.insecta-inspecta.com/ants/army/index.html>

At this site devoted to insects, visitors can learn about South American army ants in a brief, easy-to-read article.

### **The Jane Goodall Institute**

[http://www.janegoodall.org/chimp\\_central/chimpanzees/similarities/blurring.asp](http://www.janegoodall.org/chimp_central/chimpanzees/similarities/blurring.asp)

These pages about chimpanzee life, behavior, and survival needs are prepared by the Jane Goodall Institute. There are links describing Goodall's life, individual chimpanzee families, and the Institute's current studies and efforts to save the wild chimpanzees.

**Meerkats.net**

<http://www.meerkats.net/default.htm>

This Web site offers more than 100 photos of meerkats and detailed descriptions of their behavior.

**Wild Wolves: NOVA**

<http://www.pbs.org/wgbh/nova/wolves/>

Listen to wolf howls and learn what they mean. Find out how much you know about wolves and dogs with an online quiz from PBS and NOVA.

**Wilson, Tracy V. "How Bees Work," HowStuffWorks**

<http://science.howstuffworks.com/bee.htm>

This long article details the lives of bees, how a beehive functions, and the latest threats to bee survival. Learn the difference between social bees (such as honeybees) and solitary bees.

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# About the Author

**Toney Allman** currently lives in Virginia and has written more than 30 nonfiction books for students. She holds a bachelor of science from Ohio State University and a master of arts in psychology from University of Hawaii. Allman has a longstanding interest in the sciences in general and in the determinants of behavior in particular. She believes animal behavior is both fascinating and an important area of study if people are to truly understand themselves. One of her first assignments as a new graduate student was to observe the gorilla's behavior in the Honolulu Zoo.