

When Charles Darwin was working out his grand theory on the origin of species, he was perplexed by the fact that animals from ants to people form social groups in which most individuals work for the common good. This seemed to run counter to his proposal that individual fitness was key to surviving over the long term.

By the time he wrote *The Descent of Man*, however, he had come up with a few explanations. He suggested that natural selection could encourage altruistic behavior among kin so as to improve the reproductive potential of the “family.” He also introduced the idea of reciprocity: that unrelated but familiar individuals would help each other out if both were altruistic. A century of work with dozens

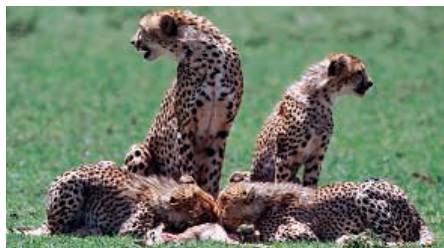
of social species has borne out his ideas to some degree, but the details of how and why cooperation evolved remain to be worked out. The answers could help explain human behaviors that seem to make little sense from a strict evolutionary perspective, such as risking one’s life to save a drowning stranger.

Animals help each other out in many ways. In social species from honeybees to naked mole rats, kinship fosters cooperation: Females forgo reproduction and instead help the dominant female with her young. And common agendas help unrelated individuals work together. Male chimpanzees, for example, gang up against predators, protecting each other at a potential cost to themselves.

Generosity is pervasive among humans. Indeed, some anthropologists argue that the evolution of the tendency to trust one’s relatives and neighbors

helped humans become Earth’s dominant vertebrate: The ability to work together provided our early ancestors more food, better protection, and better childcare, which in turn improved reproductive success.

However, the degree of cooperation varies. “Cheaters” can gain a leg up on the rest of humankind, at least in the short term. But cooperation prevails among many species, suggesting that this behavior is a better survival strategy, over the long run, despite all the strife among ethnic, political, religious, even family groups now rampant within our species.



How Did Cooperative Behavior Evolve

Evolutionary biologists and animal behavior researchers are searching out the genetic basis and molecular drivers of cooperative behaviors, as well as the physiological, environmental, and behavioral impetus for sociality. Neuroscientists studying mammals from voles to hyenas are discovering key correlations between brain chemicals and social strategies.

Others with a more mathematical bent are applying evolutionary game theory, a modeling approach developed for economics, to quantify cooperation and predict behavioral outcomes under different circumstances. Game theory has helped reveal a seemingly innate desire for fairness: Game players will spend time and energy to punish unfair actions, even though there’s nothing to be gained by these actions for themselves. Sim-

ilar studies have shown that even when two people meet just once, they tend to be fair to each other. Those actions are hard to explain, as they don’t seem to follow the basic tenet that cooperation is really based on self-interest.

The models developed through these games are still imperfect. They do not adequately consider, for example, the effect of emotions on cooperation. Nonetheless, with game theory’s increasing sophistication, researchers hope to gain a clearer sense of the rules that govern complex societies.

Together, these efforts are helping social scientists and others build on Darwin’s observations about cooperation. As Darwin predicted, reciprocity is a powerful fitness tactic. But it is not a pervasive one.

Modern researchers have discovered that a good memory is a prerequisite: It seems reciprocity is practiced only by organisms that can keep track of those who are helpful and those who are not. Humans have a great memory for faces and thus can maintain life-long good—or hard—feelings toward people they don’t see for years. Most other species exhibit reciprocity only over very short time scales, if at all.

Limited to his personal observations, Darwin was able to come up with only general rationales for cooperative behavior. Now, with new insights from game theory and other promising experimental approaches, biologists are refining Darwin’s ideas and, bit by bit, hope that one day they will understand just what it takes to bring out our cooperative spirit.

—ELIZABETH PENNISI

CREDITS (TOP TO BOTTOM): TOM BRAKEFIELD/CORBIS; M. THOMSEN/CORBIS

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