Return of the Group

People may have evolved to further collective as well as individual interests

By BRUCE BOWER

The Hutterites call themselves the human version of a bee colony. Members of this Christian sect, who first settled in the United States in the 19th century, shun personal gain and pour their efforts into a well-oiled collective enterprise.

Hutterite ideology stresses the shared fate of the group and warns against the sin of selfishness. Anyone who withholds help from others in need, turns lazy, or otherwise undermines community health draws stern reprimands from church elders. Failure to heed these warnings results in forced exile.

Hutterite leaders are elected democratically and undergo a long probationary period before acquiring full power. When a colony grows too large—which is not uncommon, as the Hutterites have long experienced high birth rates—it sorts into two groups of equal size, skill, and compatibility. A lottery determines which group stays and which moves to a new location.

Such practices sound downright strange to the average suburbanite or city dweller. Indeed, end-of-the-millennium Western societies seem to spawn far more self-absorption than sacrifice for any "greater good."

But the beelike tactics of Hutterite colonies highlight an evolved human capacity for thinking in groups and advancing group interests, even at the expense of personal strivings, asserts David Sloan Wilson, an evolutionary biologist at the State University of New York at Binghamton.

"Groups can be functional units in their own right, and individuals sometimes behave more like organs than like organisms," Wilson contends. "As a result, altruism is a common feature of both human and biological nature."

Since 1980, Wilson has waged an uphill battle to promote the study of how the evolutionary process of natural selection affects groups of organisms. Group selection—the evolution of traits that boost the survival of some groups relative to others in a population—has for 30 years been considered dead or largely irrelevant by many evolutionary biologists and behavioral scientists.

But group selection has left an imprint on many rungs of the biological ladder, new studies suggest. Examples include genomes that drive biological development by harnessing collaborative chromosomes composed of once-independent genes; the intertwined social strategies of aggressive and apprehensive lions as they protect their turf and dependents from threats; and the consensus-building skills wielded by human groups—from nomads to ocean navigators—facing complex crises and challenges.

Before 1960, group selection rode a wave of scientific enthusiasm. Researchers often referred to social groups of animals and even entire ecosystems as harmonious units adapted to their surroundings, resembling individuals in the seamless meshing of their myriad parts.

George C. Williams, an evolutionary biologist at the State University of New York at Stony Brook, blasted that view as inaccurate and naive. In *Adaptation and Natural Selection* (1966, Princeton University Press), he argued that genes engage in a fundamental struggle for evolutionary survival. As they are passed down from one generation to the next, genes help individual organisms adapt to their physical and social environment, Williams maintained.

His book inspired the concept of selfish genes, which use individual organisms as machines to promote their own survival (SN: 4/28/90, p.266).

Soon after Williams' assault on group selection, two linchpins of individual-centered evolutionary theory appeared. First, mathematical models of kin selection showed that altruism becomes more likely among genetic relatives, each of whom wants to preserve a maximum number of his or her genes for posterity.

Or to boil it down to a bumper sticker: Nepotism rules.

Then, evolutionary game theory suggested that genetic strangers manage to get along by relying on another formula: "I'll scratch your back if you scratch mine." Much of this work relied on the prisoner's dilemma model, which asks two individuals kept unaware of each other's choices to either cooperate on a task—yielding a modest mutual benefit—or act selfishly. If only one cooperates, he or she gets nothing and the selfish participant reaps a large benefit. But if both choose selfishness, each goes away empty-handed.

A new, reenergized view of group selection is emerging, particularly among evolutionary biologists, Wilson asserts. He and Elliott Sober, a philosopher of science at the University of Wisconsin-Madison, described recent group selection studies and their implications for understanding human nature in the December 1994 BEHAVIORAL AND BRAIN SCIENCES.

Natural selection preserves useful traits throughout a biological hierarchy that includes genes, individuals, groups, and populations containing interacting groups, Wilson and Sober argue. So traits can evolve that favor some genes over others in the same genome, some individuals over others in the same group, or some groups over others within a larger population.

Critics of this approach have long argued that social groups change their composition too much and too frequently to nurture natural selection. However, Wilson responds, a group consists simply of a set of individuals influenced by the expression of an inherited trait, even if the group assembles intermittently and some of its members leave or enter at various times.

Charles Darwin took this view in 1871, Wilson contends. The father of evolutionary theory wrote in *The Descent of Man* that groups of altruists ready to sacrifice for the common good survive longer and have more offspring than groups composed of self-serving members. Human morality sprang from this brand of group selection, Darwin reasoned.

In the same vein, Wilson contends that altruism and cooperation evolve only by boosting the fortunes of one group versus another, whereas selfishness evolves through individual competition within groups. Kin selection and evolutionary game theory invoke their own forms of group selection to forge alliances, he maintains. The former model depends on groups composed of individuals who have learned to recognize their genetic relatives; the latter involves groups in which individuals achieve cooperation by tracking the consequences of their interdependent decisions .

Group selection may also foster altruism through the tendency of cooperative individuals to recognize one another quickly and perceptively, according to Wilson. A social early-warning system of this type allows cooperators to cluster together and leave predominantly selfish folks to their own devices, he holds.

Social sorting along these lines occurs in mathematical simulations devised by Wilson and Lee A. Dugatkin, a biologist at the University of Louisville (Ky.). In their model, individuals choose to associate with people who exhibit varying degrees of cooperation in a series of encounters. Altruism emerges in self-selected groups of cooperators at least as strongly as in groups of genetic relatives examined in mathematical models of kin selection, Wilson and Dugatkin conclude.

These findings coincide with a study directed by Robert H. Frank, an economist at Cornell University. He and his colleagues allowed groups of strangers to interact for 30 minutes. Group members then predicted with substantial accuracy which of their comrades were most likely to act selfishly in a prisoner's dilemma game.

Related evidence suggests that humans have evolved an innate ability to discern cheaters in social transactions (SN: 1/29/94, p.72).

Altruism and deception get lots of attention from researchers, but group selection affects other phenomena as well, Wilson holds. Consider the ratio of females to males in various animal populations.

Williams argued in his 1966 book that group selection should work to maximize a population's birth rate by endowing it with more females than males. Individual selection, on the other hand, should yield a roughly equal sex ratio, giving each organism the best chance of passing on its genes. Williams concluded that no known animal species exhibits the "female-biased" sex ratio favored by group selection.

Since then, biologists have reported that females outnumber males in hundreds of species, Wilson says. The moderate, yet significant, extent of this female preponderance reflects an ongoing tension between the opposing forces of individual and group selection, he concludes.

Pressures for large-scale cooperative action provide especially fertile ground for group selection, Wilson theorizes. As a result, collective decision making assumes a vital role for some animals—honeybees, for instance.

Cornell biologist Thomas Seeley characterizes honeybee hives as single "superorganisms." Each hive renders verdicts on a minute-by-minute basis concerning which flower patches to visit and which to ignore in an area of several square miles, how to allocate workers to either foraging or hive maintenance, and other vital concerns.

Seeley describes experiments that pry into the discerning habits of bee colonies in *The Wisdom of the Hive* (1995, Harvard University Press). When the hive faces key judgments, each bee offers a small contribution to a chain of responses that produces appropriate divisions of labor or other outcomes. At such times, hive members resemble neurons in a brain rather than independent agents, Seeley contends.

Higher up the food chain, social groups often have to negotiate uncertain environments in which it pays to have both daring and reserved members on hand, Wilson asserts. One instance of this facet of group selection occurs in prides of lions.

“Organized groups may have cognitive properties that differ from those of the individuals who constitute the group.”

— E. Hutchins

New research indicates that, within prides, some adult females serve as aggressive leaders who readily defend territory against intruders, while others emerge as laggards who always or frequently hang back in the face of such danger.

Lead females recognize the laggards in their midst but do not punish them, say Robert Heinsohn of Australian National University in Canberra and Craig Packer of the University of Minnesota in St. Paul. This suggests that cooperation in lion prides does not arise exclusively from the exchange of favors or expectations of future help between individuals, the researchers report in the Sept. 1 SCIENCE.

Some laggards join attacks on outsiders when they are most needed, but others shrink even further from potentially serious frays, Heinsohn and Packer add.

The presence of some females who always meet threats head-on and some who pitch in when necessary ensures the protection of both a stable territory and essential pride members, they theorize. The role of hard-core laggards remains unclear, although to some extent those lions appear to exploit the pride for personal gain.

Combative and restrained lions may offer a peek into the vexing question of why humans exhibit personality differences, the scientists suggest. Leaders and laggards in lion prides may correspond to producers and scroungers in human foraging groups or to bold and shy individuals, in their view.

About the same time that group selection fell from grace in biology, popular notions of "the group mind" advanced by psychologists and other social scientists in the first half of this century met resistance. As in biology, the individual assumed center stage.

Group decisions acquired an ominous aura of ineptitude, epitomized by the concept of groupthink. This theory, propounded in 1972, holds that pressures for unanimity in close-knit groups warp reasoning and moral judgment, especially on complex matters.

But Wilson found, in a review of 496 psychological studies of group decision making published between 1985 and 1994, that collective rulings deserve more respect. "When I actually read the details of the studies, I discovered that groups frequently are much better than individuals at making decisions," he contends.

The studies indicate that, contrary to groupthink theory, the best decisions occur in tight-knit groups addressing tough problems, Wilson notes. Experimental groups working cooperatively outperform most individuals in those groups on problem-solving tasks, and they usually do about as well as the sharpest solo decision maker in a group.

The few psychologists who study groups operating in the real world have uncovered intriguing clues to the power of collective judgments without ever mentioning group selection, Wilson argues. For instance, Edwin Hutchins of the University of California, San Diego studied 10-man navigation teams on Navy aircraft carriers and amphibious helicopter transports. Navigation teams conduct complex calculations to maneuver huge vessels into and out of harbors. Once a ship gets safely away from shore, a single navigator assumes the helm.

Navigation teams function as single entities, Hutchins asserts in *Cognition in the Wild* (1995, MIT Press). Members position themselves so that mistakes made by one person can be caught by someone else. Tasks merge together so that the team can cover for a member who gets called away. When an experienced member leaves permanently, his replacement is initiated into lower-level tasks so that team functioning stays on an even keel.

"Organized groups may have cognitive properties that differ from those of the individuals who constitute the group," Hutchins writes.

This comes as no shock to Christopher Boehm, an anthropologist at the University of Southern California in Los Angeles. Group selection shaped decision making throughout much of human prehistory, Boehm argues. Stone Age survival tactics preserved genes that facilitate people's ability to fit into relatively small bands, which pool available information and solve pressing problems collectively.

This evolved capacity may help to explain why navigation teams routinely keep aircraft carriers from plowing through docks and why the Hutterites avoid cultivating crops of conniving schemers worthy of television's *Melrose Place.*

Surveying the limited ethnographic literature on tribal decision making in crises, Boehm identified three detailed descriptions of emergency judgments made by communities of nonliterate foragers or livestock herders. Their decisions concerned potential responses to violent attacks by other tribes or to a sudden food shortage. In each case, consensus was reached largely through rational considerations. Superstitions and cultural conventions carried little weight in the verdicts, Boehm reports in an article slated to appear next year in CURRENT ANTHROPOLOGY.

For instance, a highland New Guinea tribe decided to raid a nearby tribe after convening a meeting of all former and current members of a society for adult males. Several leaders solicited the candid views of everyone present and withheld their own opinions early on. After hours of debate, an appointed "big man" summarized arguments for and against an attack and announced that it would indeed take place. Dissenters then experienced considerable social pressure to take part in the raid, since the tribe's survival was at stake.

This type of egalitarian decision making, practiced by nomadic groups that keep their leaders on a short leash, has predominated for at least the past 50,000 to 100,000 years, Boehm contends. In a related study, published in the June 1993 CURRENT ANTHROPOLOGY, Boehm used ethnographic records to document egalitarian political systems in 48 tribal societies throughout the world. These groups vigilantly monitor and control their leaders' access to big game meat and reproductive partners, he contends. Collective decision making further restrains leaders' personal ambitions.

An egalitarian system gives an evolutionary edge to traits that serve group interests, such as cooperation, and dampens (but does not stamp out) those that further individual aims, such as deception, Boehm maintains. Moreover, differences in the ways groups deal with climate change, competition for food sources, and other threats can dramatically alter their reproductive fortunes. Thus, repeated confrontations with crisis decisions may have magnified the effects of group selection on Stone Age humans.

"I know I'm attacking a cathedral of individual selection theory," Boehm says. "Advocating group selection as a force in human evolution has become like violating the incest taboo."

Indeed, evolutionary psychologists, who take a Darwinian approach to studying the mind, overwhelmingly concentrate on individual selection and consider group-level adaptations relatively rare (SN: 4/8/95, p.220). Many would agree with Williams, who asserts that Wilson "engages in a kind of pedantic extremism by labeling all sorts of ephemeral groups as vehicles of natural selection."

Determined researchers can find ways to attribute cooperation, morality, and other group-oriented traits to the myriad deceptions of ultimately selfish individuals, Wilson responds.

"Evolutionary biology and other fields are sharply split regarding group selection," he remarks. "It will take decades for a full consensus to emerge."

Next week: Ultrasocial Darwinism—cultural groups may call the evolutionary shots in modern society. □

Paleontology

Richard Monastersky reports from Pittsburgh at the annual meeting of the Society for Vertebrate Paleontology

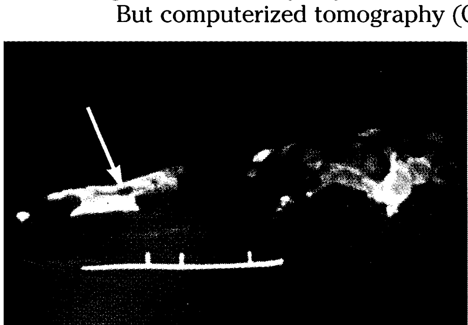
What lurks inside a dinosaur's nose?

In one of the more bizarre research crazes these days, scientists are racing each other to look up the nostrils of extinct beasts. Their quarry: a set of delicate bones that can tell whether an animal was warm-blooded (endothermic) or cold-blooded (ectothermic).

The current nasal fetish stems from an ongoing debate about dinosaurs. Although paleontologists once saw them as sluggish ectotherms, many now envision dinosaurs as endotherms. The debate rages on for lack of definitive evidence.

Enter respiratory turbinates. These thin, scroll-shaped bones or cartilage appear in the nasal passages of almost all modern endotherms, according to physiologists John A. Ruben of Oregon State University in Corvallis and Willem J. Hillenius of the University of California, Los Angeles. Covered with a moist membrane, turbinates humidify and warm air going into the lungs and dehumidify air on its way out, thus cutting down on water loss. Their presence in a fossil animal signals endothermy, say the researchers (SN: 5/14/94, p.312).

But computerized tomography (CT) scans of several theropod dinosaurs showed no evidence of respiratory turbinates in these active predators, reports Ruben. That puts a chill on the idea of endothermic dinosaurs.



Andrew Leitch

Arrow shows a theropod's narrow nasal passage.

Defenders of the warm-blooded theory thought they might get support from paleontologist John R. Horner of the Museum of the Rockies in Bozeman, Mont. Horner reported finding some unusual nasal structures on CT scans of a duck-billed dinosaur. But he eventually agreed with Ruben that the bones are not respiratory turbinates.

The pushy side of mammalian brains

The bones of the middle ear make a strange journey in growing mammals, one that has puzzled developmental biologists for almost 200 years. The tiny ear ossicles start out as part of the jaw. As the embryo matures, the ossicles tear away from the jaw and migrate backward, eventually attaching to the skull. Paleontologist Timothy Rowe of the University of Texas at Austin thinks he has an explanation for the movement: Our bulging brains are to blame.

Rowe started his study with a few facts. In the reptilian ancestors of mammals, the bones of the middle ear remained connected to the lower jaw. But when the earliest mammals appeared in the fossil record 160 million years ago, they showed the novel ear arrangement. They sported other new features as well, among them a greatly expanded brain. Rowe wondered whether the two had some connection.

Examination of opossum embryos provided a test. The paleontologist followed brain growth and ossicle position from early life through maturation. While the ossicles stopped growing after 3 weeks, the brains continued to enlarge for another 9 weeks, putting pressure on the ear bones.

"The growth of the brain tears the ear ossicles from the jaw and pushes them backward until they reach adult position," says Rowe. He reasons that the evolution of a more specialized brain in early mammals caused the middle ear to split from the jaw.