Abstractions

SOLE AUTHOR
Evolutionary biologists have long been interested in cooperation between animals, especially cases in which one animal assists an unrelated animal at some cost to itself. Why should individual animals help non-kin? A common theory has been that such cooperative actions are reciprocated and represent exchanges of resources or services between individuals. In a review on page 51, zoologist Tim Clutton-Brock of the University of Cambridge, UK, examines a wide body of theoretical and empirical studies and concludes that simpler mechanisms are often involved. He tells *Nature* more.

Do unrelated animals often cooperate?
Empirical evidence suggests that they do, but not for the reason proposed by theoreticians. In non-human animals, most cooperative interactions involve relatives. Extensive cooperation between unrelated individuals is uncommon, and seldom involves activities likely to be of substantial cost to the one providing the favour. For example, unrelated animals rarely feed each other's offspring, a comparatively common activity among relatives. In this respect, human cooperation — which often involves non-kin — is unusual.

Why is it unlikely that exchange is involved in cooperation between unrelated animals?
There is a fundamental problem with the reciprocity explanation. Interpreting cooperative interactions as exchanges means that it would pay for individuals to 'cheat' and accept assistance but not provide it. Moreover, there's very limited empirical evidence that individuals exchange assistance in this way.

Why did you undertake this review?
Because of the disparity between theoretical and empirical studies of cooperation. Theoretical studies generally explain cooperation between non-kin as exchanges of assistance. However, empirical studies suggest that the cooperative participant either gains immediate net benefits or is coerced or manipulated by the beneficiary into providing assistance. It may be that the prevalence of cooperation between non-kin in humans, where reciprocity is common, has influenced theoreticians' thinking.

Why is this conclusion important?
It would be unfortunate if theoretical research on animal cooperation continued to focus on an approach that empirical studies suggest is of limited relevance. For our understanding of the evolution of animal cooperation to develop, theoreticians should devote as much effort to exploring mutualistic and manipulative interactions as they have to models of reciprocity. ■

MAKING THE PAPER

David Weitz

A study to ascertain glass formation needed the right blend of people.

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Glass is traditionally made from liquids — composed of molecules moving freely about — that become solid without crystallizing. But glass can also be made from other substances that end up more or less 'glass-like'. David Weitz's physics lab at Harvard University in Cambridge, Massachusetts, found that soft colloidal particles — bits of solid suspended in a liquid — can be made to form glass with remarkably similar properties to more traditional kinds (see page 83).

Most attempts at using colloids to make glass have focused on the more common 'hard' varieties of colloids. But Weitz was intrigued by soft colloids. "We realized their behaviours were very different," he says. Most colloid particles — especially hard ones — are spherical. But soft colloid particles can become irregularly shaped when they are squeezed together in greater densities. Would this property modify the motion of the particles, changing the way they solidify into a glass?

Weitz did not initially set out to study how these soft, more deformable, colloids might form glass. The lab's movement in that direction came when postdoc Johan Mattsson, who had studied glass formation during his PhD training in Sweden, joined the lab. Meanwhile, Zhibing Hu, a colleague from the University of North Texas in Denton, had been creating and characterizing a unique class of microgel — soft colloidal particles made by combining two different polymers that allow control of the degree of softness of the resultant particles.

The group started thinking that using these particles, and controlling their softness, might enable them to tease out how this characteristic affects glass formation. "It was a convergence of interests and diverse expertise that led to these results," says Weitz.

The lab used three colloids of different softness, and mixed them at various concentrations and temperatures. They found that changing the softness of the particles could produce very different behaviours. "When you can heat the particles up, you can shrink them, by taking some water out of them," says Weitz.

Next they observed how glass-like their mixtures were by using light-scattering techniques and measuring the substances' responses to mechanical force. They then compared measurements in soft-colloid-derived glasses with more standard-type glasses.

They found that the softer, more deformable particles approached the glass state much more gradually than the stiffer, less deformable ones. This richness in behaviour is similar to that of more traditional molecular glasses, which behave differently depending on the type of molecules from which they are formed. It had never, however, been seen in colloidal or particulate glass-forming systems.

Understanding glass formation by soft colloids is of more utility in understanding other materials than in practical applications as a new kind of material. "Most practical systems are made up of what I call soft materials — particulates, emulsions, polymers, suspensions — things that are around us in our everyday life," says Weitz. "Many of these systems will exist in some kind of glass-like state. The nature of this glass-like state is one of the most important features to make these materials useful." ■

FROM THE BLOGOSPHERE

"How to explain science to your friends?" asks Steffi Suhr on her Nature Network blog, Science Behind the Scenes (see go.nature.com/WFibv4). After jumping into a Facebook discussion "with lots of really stupid misinformation on H1N1 vaccinations", Suhr contemplates what scientists should say when non-scientist friends come asking for advice on all manner of topics.

Suhr, a management-board assistant at European XFEL, a synchrotron facility currently under construction in Hamburg, Germany, writes that although she is most comfortable discussing topics such as climate change and iron fertilization, she more often gets pulled into conversations on alternative medical treatments.

Her first rule of engagement is "Don't be confrontational!". Rules two and three emphasize that science is not a belief system.

Suhr thinks that it is vitally important for scientists to talk about science and not dodge certain discussions. She ends with this plea: "We can't screw this up." Her post generated a humorous discussion of others' encounters with non-scientist friends and colleagues. ■

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