# What is the meaning of 'one'? Evolutionary biologists argue for new meaning of 'organismality'

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Rice University evolutionary biologists David Queller and Joan Strassmann argue in a new paper that high cooperation and low conflict between components, from the genetic level on up, give a living thing its "organismality," whether that thing is an animal, a plant, a bacteria - or a colony.

Some of the traits scientists use to describe an organism, such as individuality or even membership in the same species, may not be necessary to achieve organismality. What is necessary, they argue, is a commonality of interests and minimal conflict that when combined, makes this the premier level of adaptation.

Queller and Strassmann, the Harry C. and Olga K. Wiess Professors of Ecology and Evolutionary Biology, address what they call "the truly central questions about the organization of life" in "Beyond Society: The Evolution of Organismality," published this month in the *Philosophical Transactions of The Royal Society Biological Sciences*.

"This is more than a semantic game of deciding that X is an organism and Y is not," they wrote. "The scientific community could choose any name they want for entities with extensive cooperation and very little conflict, but the existence of such entities is one of the striking features of life, and explaining how they evolve should therefore be an important task."

The ideas they present have been bubbling just below the surface of their extensive research into the conflicts and cooperation that drive Dictyostelium amoebas (slime molds) and social insects.

"Adaptation is what makes living things different from nonliving things, to my mind, so the concept of organism is centered on that," Queller said. A colony of honeybees is an organism, the authors argue, because of its sense of shared purpose. A high degree of cooperation and low level of conflict - even when the potential for conflict is there - is a primary trait of an organism, whether its components share a body or not.

Their scheme centers on charts that separate living things into four groups, based on observed levels of cooperation and conflict. "One thing I think is really important about the paper, and it's fairly simple, is the idea that the opposite of high cooperation is not conflict. It's absence of cooperation," said Strassmann. "That allows us to put conflict on a different axis from cooperation, and divide the social space into organisms, societies, competitors and simple groups."

Queller and Strassmann analyze dozens of species in three distinct classes of groups to determine where they land on the organismal charts, based on their levels of cooperation and conflict.

On the cellular level, whales, mice, redwoods, the malarial parasite Plasmodium in mosquitoes and Dictyostelium rank high on the organismality scale for their levels of cooperation with little conflict.

Humans are obviously organismal, Queller and Strassmann agree. All the body parts, from the macro level (arms and legs) to the micro (cells) work nicely together with very little conflict. But unlike the honeybee colony, a city is not organismal. Though the human colony requires a great deal of cooperation to keep it running, it is, they said, "far too full

of conflicts."

On the level of groups of multicellular individuals, the Portuguese man-of-war is a paragon of organismality. Technically a colony of sea-going polyps, each polyp seems to know its place, taking on a specialized duty that contributes to the survival of the whole. "The cooperators have become so close as to blur their boundaries," they wrote.

In the third grouping of two-species pairings that may seem simply symbiotic, they find close cooperation without conflict is often necessary for the survival of both parties. The relationship between mitochondria and the host cells they power is one example; bobtail squid and the bacteria that allow them to light up in return for sustenance is another. The authors put the relationship between lions and gazelles at the opposite end of the scale for obvious reasons.

More information: View the paper online at rstb.royalsocietypublishing.or … content/364/1533.toc

Source: Rice University (news : web)