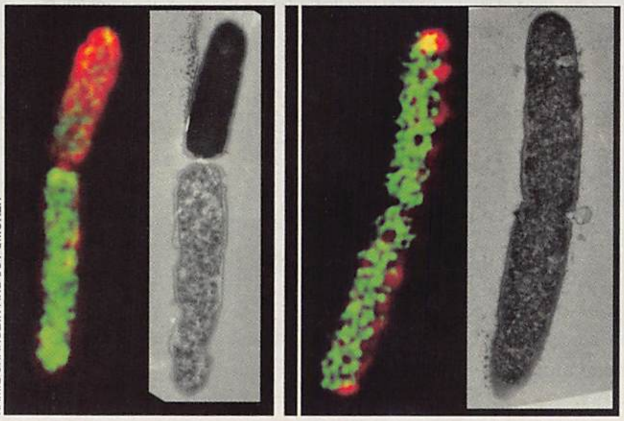
Mergers and Acquisitions

Microbial communities can include thousands of species of bacteria, fungi, and other microorganisms living together. These communities are known to engage in syntrophy—mutually beneficial relationships in which the microbes live off the metabolic products that other species produce. Scientists have now observed two distinct bacterial species going farther than simply sharing their outputs. The two cells fused together, leading to an exchange of genetic material and ultimately the formation of hybrid bacteria that were able to grow and thrive.



KAMIL CHARUBIN AND JOY SMOKER

Fluorescent and electron microscopy images show two bacteria of different species fusing (left) and subsequently hybridized (right).

The phenomenon was reported for the first time in a study led by chemical and biomolecular engineer Eleftherios Papoutsakis and his colleagues from the University of Delaware. The scientists observed a pair of bacteria of different species—*Clostridium ljungdahlii* and *C. acetobutylicum*—that live in syntrophy. The researchers cultured the two bacteria in the same dish and used transmission electron microscopy to watch what happened in real time. They found that the two oblong bacteria appeared to line up end to end and fuse their cell walls at the poles.

To better understand the process, Papoutsakis and his team tagged proteins and RNA in each bacterium with a different fluorescent marker. As the cells fused, the scientists observed the large-scale exchange of proteins and RNA between the two species. Using another technique called flow cytometry, they were able to determine how quickly the RNA exchange happened. They found that genetic material was swapped between the bacteria in as little as two hours.

The team continued to follow the cells after the fusion event, watching cells that contained a mix of RNA and protein from both microbes. Microscopic images revealed that these cells had the same appearance, which resembled neither *C. ljungdahlii* nor *C. acetobutylicum*. Both bacterial cells appeared to be hybrids of the two species. Follow-up studies also showed that the hybrid cells grew and divided on their own.

Scientists are still working to understand the various roles of microbiomes in regulating bodily functions and other natural processes. The finding that microbes can share genetic material through fusion may help them learn more. "Such fusion events are likely widely distributed in nature, but have gone undetected," the authors wrote. "The implications are profound and may shed light onto many unexplained phenomena in human health, natural environments, evolutionary biology, and biotechnology." (*mBio*)

—Sheena Scruggs

Social Learning

Since the mid-1800s, house sparrows (*Passer domesticus*) have spread from Europe and Asia to Australia, Africa, and the Americas. These social songbirds have expanded their range into many new habitats and appear to thrive in human environments. A study from Louisiana State University in Baton Rouge suggests that house sparrows can adapt their behavior based on what they learn from one another—perhaps shedding light on why this species has been so successful worldwide.

The research team captured twelve male and twelve female birds and housed them in individual cages for several weeks while the birds adjusted to the lab setting. The scientists recorded the birds' reactions when harmless new objects, such as yellow pipe cleaners, gold bells, and purple plastic eggs were placed near their feeding bowls. Some birds were neophobic and slow to feed in the presence of these new objects. Other sparrows were less afraid and quickly approached the birdseed, despite the presence of the novel objects.

Researchers classified each bird, based on its approach time, as either cautious or more daring. The birds were then divided into twelve pairs and each pair was put in a new cage. Five pairs had similar personality types, while the other seven were a mix of personalities. After a few days, the researchers introduced new objects and again observed the birds' reaction.

Birds sharing cages with partners that were equally or more cautious than they were showed an increased wariness of new objects. Once they were back in their own cage, they reverted to their previous patterns of feeding. Cautious birds paired with more daring partners, however, became bolder and fed more quickly—even after they were returned to their own cage. These changes were still observed a week after the birds had been separated. The results "show behavior can change in response to social learning," said lead author Christine Lattin.

SHUTTERSTOCK

Sparrows can learn from each other to be less fearful of new experiences, thereby possibly helping them adapt to a variety of human environments.

In every trial, the birds were exposed to a different object, suggesting that their learning was not just related to specific objects. "They learned that something weird near the food dish is not a threat," said Lattin. The findings suggest that house sparrows can extrapolate information gleaned from their flock mates and apply it to new situations, which may have helped them spread into so many new environments. (*Biology Letters*) *—Niki Wilson*

Acquired Taste

Humans have different cultural food preferences, which we pick up from the people around us. But scientists have debated whether bonobos (*Pan paniscus*), one of our closest primate relatives, also display such culturally driven traits. Researchers tracking the eating habits of bonobos at the Kokolopori Bonobo Reserve in the Democratic Republic of Congo have found evidence that the social apes have group-specific food preferences that they learn through cultural transmission. The finding could have implications for how humans evolved our capacity for culture.

Liran Samuni of Harvard University and the Max Planck Institute of Evolutionary Anthropology in Leipzig, Germany, led the study. She and her colleagues followed two habituated groups of bonobos with largely overlapping home ranges to track where and what they ate. Most groups of social animals live in distinct territories, making it difficult to determine if any dietary differences are cultural or simply because different foods are available, explained Samuni. Studying two groups with a shared range allowed the researchers to disentangle the effects of social learning from those of circumstance.

Bonobos have a varied diet that can include fruits, leaves, flowers, insects, mushrooms, and small mammals. In Kokolopori, two rare protein sources make for high-quality treats: tree-dwelling rodents called anomalures (genus *Anomalurus*) and duikers (subfamily Cephalophinae), small terrestrial antelopes. After five years of field work and GPS tracking, the scientists determined that each bonobo group preferred to chase down a different mammal. One group hunted thirty-one anomalures and only one duiker, while the other group captured eleven duikers but only three anomalures. More than 80 percent of all hunts were in overlapping areas, and each group pursued its favorite prey even in areas predominantly used by the other group. That suggested that the two groups' different tastes were not dictated by availability.

LIRAN SAMUNI

Scientists have found that bonobos share food preferences they learn from each other.

Scientists had previously found that chimpanzees can also have cultural differences between groups. "I think it puts the evolutionary history of our species in some perspective," said Samuni. Our common ancestor likely had the capacity for culture, she added, underlining the importance of social learning in creating behavioral diversity. The researchers next hope to study how young bonobos pick up these culturally driven dietary preferences from their elders. (*eLife*) —*Lesley Evans Ogden*

Moon Rust

On the Moon, where there is virtually no free oxygen, iron stays in its unoxidized elemental form—or so researchers thought. Planetary scientists now report the discovery, at high lunar latitudes, of hematite, an oxidized iron-containing mineral. The team contends that the only plausible source of the oxygen is Earth itself.

Shuai Li, an assistant researcher at the University of Hawaii Mānoa School of Ocean and Earth Science and Technology, and colleagues noted the distinctive spectral signature of hematite in observations taken by the Moon Mineralogy Mapper instrument aboard India's Chandrayaan-1 lunar orbiter. The hematite was found in the Moon's polar regions and overlapped with the previously observed locations of trace amounts of water, which is necessary for the mineral to form. Hematite was more prevalent on the Moon's near side, the hemisphere that constantly faces Earth. Based on this fact, the authors hypothesize that oxygen blown out of Earth's atmosphere by the solar wind—a stream of charged particles emanating from the Sun—eventually reaches these lunar regions, where it reacts with iron and scarce water to yield the observed hematite.

The discovery that Earth and the Moon may be connected in this way was unexpected. "We did not realize that Earth may have played big roles on the evolution of the surface of the Moon," said Li. If the researchers' hypothesis is correct, hematite in craters of different ages may have preserved the chemical signatures of Earth's atmosphere at different periods in its history. It is possible that other gases stripped from Earth's atmosphere have modified the lunar surface over the eons as well, added Li. The team hopes samples collected by a future Moon mission could help confirm their hypothesis—as well as offering insights into the evolution of Earth's atmosphere. (*Science Advances*) —*Adam Hadhazy*

SHUAI LI

Red shading in this image indicates regions where the oxidized mineral hematite was found on the near side of the Moon.