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The Self-Medicating Animal

What can we learn from chimps and sheep and maybe even insects that practice medicine on themselves?

By MOISES VELASQUEZ-MANOFF MAY 18, 2017

Chausiku was clearly sick. The chimpanzee was in her 30s, a chimp's prime. She was usually a gentle, doting mother. But one day she built a nest in a tree, climbed in and lay down, letting her infant, a male named Chopin, roam unsupervised. Another female chimp began looking after Chopin while Chausiku rested.

Later that day, after Chausiku descended from the tree, a scientist named Michael Huffman noted that she could barely walk. Huffman wasn't there to watch Chausiku specifically; he was studying older chimps, researching their social relationships in the troop. But Chausiku did something so out of the ordinary that it captured his attention: She sat down in front of a leafy plant, began pulling off branches, chewing their tips, spitting out the fibrous pulp and swallowing only the juice.

This was in Tanzania, in 1987, when Huffman was just starting his career as a primatologist. In nine months of watching Chausiku's troop, he had never seen a chimp eat that plant. He asked his friend and research aide, a man named Mohamedi Seifu Kalunde, what it was. Kalunde hailed from the nearby Tongwe people and worked as a ranger at the chimp-research project in Mahale Mountains National Park. The plant Chausiku was chewing, Kalunde told him, was extremely bitter and could be poisonous in large quantities. But it was also "very powerful medicine." The Tongwe used it to treat stomach ailments and parasite infections.

Huffman decided to abandon the other chimps he was trailing and focus on Chausiku. She went to bed early that evening and remained weak the next



through the forest, until she reached a spot near the edge of a swamp, where succulents and figs abounded. Chausiku began gorging. “She spends the next few hours stuffing her face as if she were really hungry,” Huffman recalls. When Kalunde told him the plant typically took about 24 hours to work, Huffman felt almost intoxicated by the possibility that he had just seen a chimp use medicine.

That wasn’t the first time scientists had observed what looked like self-medication in the animal kingdom. More than a decade earlier, the primatologist Richard Wrangham and his colleagues noted that chimps often swallowed whole leaves without chewing. The scientists would go on to argue that these chimps were treating parasite infections, and they eventually coined the term zoopharmacognosy — animals that know medicine — to describe the behavior. But that claim met with some skepticism. Whether those leaves actually contained chemical compounds toxic to parasites was unclear. Nor could the researchers prove that these chimps had been sick and became well after self-medicating.

Mindful of these shortcomings, Huffman began collecting fecal samples from Chausiku’s troop to get a sense of their parasite loads. Biochemist colleagues analyzed the broad-leafed plant, *Vernonia amygdalina*, and discovered more than a dozen new compounds with antiparasitic properties. After chimps chewed the plant, Huffman would come to learn, parasite loads (as measured by eggs in their stool) decreased by as much as 90 percent in a day. The plant was an effective dewormer. It was also known to kill domestic goats in West Africa, and that toxicity highlighted the apparent skill with which the chimps exploited the plant. Somehow they used enough to kill parasites, but not so much as to kill themselves. They also tended to chew more *V. amygdalina* during the wet season, when parasites were more abundant, indicating that they sought its medicinal benefits when they needed them most. They seemed to target one parasite in particular, a nasty worm called *Oesophagostomum stephanostomum* that could cause painful nodules along the intestinal wall and even, in severe infestations, death.

Huffman, a professor at Kyoto University in Japan, has since become a




contribution to this increasingly nuanced understanding of our nearest relative has been to establish that, even though they lack the abilities we consider might be necessary for the development of medical knowledge — namely, humanlike language — chimps practice a form of rudimentary medicine. They know enough about the plants around them to treat illness.

Animals of all kinds, from ants and butterflies to sheep and monkeys, use medicine. Certain caterpillars will, when infected by parasitic flies, eat poisonous plants, killing or arresting the growth of the larvae within them. Some ants incorporate resin from spruce trees in their nests to fend off pathogenic microbes, employing the same antibacterial compounds, called terpenes, that we use when we mop the floor with the original Pine-Sol. Parrots and many other animals consume clay to treat an upset stomach; clay binds to toxins, flushing them out of the body. “I believe every species alive today is self-medicating in one way or another,” Huffman told me recently. “It’s just a fact of life.”

Capuchin monkeys use poisonous millipedes and citrus as insect repellent. With howler monkeys, self-medication may veer into social engineering. Ken Glander, an emeritus scientist at Duke, thinks that female howlers sometimes seek out foods that change the acidity of their reproductive organs after mating. By changing the pH balance, he told me, these females may promote the success of male over female sperm, resulting in more male offspring. Should one of those males rise in a troop and sire many children, his mother’s genes are also spread with them.

Is what seems to be self-medication simply another instinctual behavior, like the urge to procreate or eat when hungry? Or is it a skill that animals acquire through experience? Most scientists I spoke to pointed out, almost bashfully, that natural selection could produce self-medicating behaviors without the humanlike learning and sharing of expertise that we associate with medical treatment. Animals that happen to eat medicinal plants at the right time might survive more successfully than those that don’t, causing that behavior to spread.

Smaller-brained animals, like caterpillars and ants, are probably self-medicating as a matter of instinct. Even monkeys, with their larger brains,




experience what medicinal plants to draw on and when. There appears to be no hard line in our imagined hierarchy of the animal kingdom, below which self-medication is instinctive and above which medicinal behavior derives from learning.

Chimps and other great apes differ, of course, from many other animals. They have culture that we recognize as such — and Huffman considers medical knowledge part of that cultural inheritance. Young chimps closely watch what their mothers eat, and he suspects that this is how they learn what plants to make them better. Chimps in other troops chew different plants than Chausiku did, suggesting that their medicinal knowledge is specific to their environs, not hard-wired. But not everyone thinks the science is settled.

Moreover, it's still unclear how an infant watching its mother learns to associate bitter-tasting plants with physical relief, given that the mother, not the infant, is the one experiencing it and that the effect may not be felt until a day or more after dosing. "That's the puzzle," the well-known primatologist and author Frans de Waal told me. And how do they discover medicinal plants to begin with, particularly given their usual bitter taste? "It doesn't sound logical to me," he said, "but it must have happened, because we see animals flock to certain resources when they're sick."

Huffman thinks that people may have acquired medicinal knowledge through the observation of animals. He often tells a story he heard from his friend Kalunde, who died in 2013, to illustrate the point. Kalunde's grandfather, a healer, once watched a sick porcupine eat the roots of a plant known to be quite poisonous. When the porcupine recovered, Kalunde's grandfather began experimenting with the root in small doses, first on himself and then on fellow villagers. It turned out to be an effective treatment for dysentery, one the Tongwe still use today.

The ability to observe and imagine the experiences of other animals may have allowed people to tap into ancient, nonhuman medicinal knowledge — "clinical trials that have been ongoing for thousands of years and selected for by natural selection," Huffman says. "There's nothing better than that."



"The Trouble With Science" that not only is science not unique to the West or to the developed world, but that it's not exclusive to humans. "Science is a genuine universal, characteristic of all advanced life-forms," he writes. It's how living things figure out the world around them.

To make the case, he cites the behavior of an African bird called the honeyguide, which leads people to beehives with a series of calls, then shares in whatever honeycomb is extracted. Dunbar contends that the honeyguide has developed a theory of human behavior, most likely extrapolated from its relationships with other animals, like the honey badger, which it also leads to beehives.

Most researchers on animal self-medication demur when asked if the subjects of their study are practicing science, but Juan Villalba, a scientist at Utah State University, thinks that animals practice at least some aspects of what we call the scientific method. He has spent a lot of time watching sheep graze. Sheep know how to choose nutritious food, but like other animals, they regularly eat plants with no obvious nutritional value, perhaps for medicinal reasons. Inspired some years ago by Huffman's work on chimps, Villalba began looking into how sheep learned which medicinal plants to eat.

He started by spiking their regular food with tannins. These organic compounds, responsible for the astringent, mouth-puckering quality of red wine, have evolved in plants to help counter various stresses, including being eaten by animals. They're meant to taste awful, and sheep usually avoid them. But they also have antiparasitic properties. So Villalba infected lambs with parasite larvae and divided them into two groups; he fed tannin-spiked food to one group and plain feed to the other. The parasite loads in animals that ate tannin-rich food dropped relative to those that did not. When Villalba again offered infected animals a choice of tannin-enriched or regular feed, only the lambs that had experienced the bitter forage's antiparasite effects chose it. Animals that hadn't cured themselves stuck with regular food and remained infected with parasites.

"There's a learning process that needs to take place in order for them to develop a preference for foods that contain those medicines," Villalba says.



that they didn't need to self-treat. Villalba has also found that lambs and ewes learn about medicinal foods faster when they're together (rather than alone), as if primed for a transfer of medicinal knowledge. This could explain how, once acquired, medicinal understanding is maintained in groups of animals.

The abiding question — the greatest puzzle of all, really — is how animals first learn which plants are medicinal. Villalba has observed that lambs infected with parasites are more likely to try new plants when grazing in an open pasture compared to uninfected lambs. They lose some of what scientists call food "neophobia," the fear of new flavors, and their greater willingness to explore the surrounding foodscape may increase the odds of a medicinal discovery.

Huffman calls these tendencies "pre-adaptations." They're hard-wired behaviors that push animals toward the acquisition of medical knowledge — in this case, by impelling them to try the very flavors they normally shun. Arguably, this exploratory behavior exhibits a fundamental insight about the world, which, fully articulated, might go like this: Plants have evolved an exquisite array of poisons and noxious compounds to protect themselves. Many of these are directed at invertebrates and microbes, relatives of what makes an animal sick. So a terrible-tasting plant, one usually avoided, has a better-than-average chance of beating back whatever is making that creature ill.

Monkeys and apes and sheep aren't performing surgery. They haven't invented vaccines or figured out how to manufacture insulin. Even older medical traditions, like those in which Mohamedi Kalunde's grandfather worked — informed by observation and developed through experimentation — are surely far more advanced than what animals manage to do. But they may still provide us with medical insights. Huffman points out, for instance, that while we tend to isolate just one molecule for our drugs, animals use plants that produce multiple antimicrobial and antiparasitic substances at once. By ingesting what's really a drug cocktail, animals minimize the problem of antibiotic resistance.

Villalba's research may have practical implications. Resistance to antiparasite medication is a growing problem for livestock and people alike. But if grazing animals are able to medicate themselves, perhaps ranchers should make a



lessen the risk of antibiotic-resistant superbugs emerging from livestock operations. Anecdotally, Villalba says, ranchers already report that livestock grazing in wilder, more diverse pastures are healthier than those confined to smaller spaces, possibly because they are able to self-medicate.

A similar approach might help the honeybees that are so important for crop fertilization and that have been dying at an alarming rate in recent years. Bees collect resins from certain trees to protect themselves against infection, a form of social immunity or communal self-medication. But these days, with sources of resin scarce in agricultural settings, honeybees may lack those defenses, says Marla Spivak, an entomologist at the University of Minnesota. The unavailability of resins could be one factor making them vulnerable to disease.

It's worth considering the ways that animals, precisely because of their more limited intellects, might be more doggedly scientific than we are. After all, while animals seem to attend closely to cause and effect, learning from experience, people sometimes indulge a penchant for spinning out grand theories from scant (or no) evidence and then acting on them. Bloodletting, for example, persisted for hundreds of years in Europe even though it almost certainly weakened and killed the sick. It was based on the ancient humoral theory of disease: Illness arose when the body's "humors," or essential fluids, were out of harmony, an imbalance corrected by draining blood, among other acts. Other ineffectual and even dangerous treatments include smoking to treat asthma and sexual intercourse with virgins as a cure for syphilis.

Animals no doubt blunder in their attempts to self-medicate. But humans seem to be unique in their capacity for clinging to beliefs and theories about the world, even when facing evidence that refutes them. Consider those religious sects that refuse modern medicine altogether, favoring prayer instead, and whose believers sometimes die as a result. Chausiku and her kind would probably never err in this way, simply because the medicine that chimps practice derives from what they've learned through trial and error, not from untested explanations for how the world works.

Historically, some currents within evidence-based medicine — treatment



get carried away in extrapolations. In a way, the evidence-based mantra is partly an exhortation to be more animal-like. Don't rely too heavily on theories, assumptions or grand cosmological narratives. Instead, be empirical and focus on what's right in front of you.

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