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Cephalopods

“Me Tarzan, you Jane.” If the male cuttlefish could speak, this might be his opening line. Although cuttlefish don’t primarily use sound to communicate, the male still has an opening line, and it might translate to the longer, but conceptually simpler, “Me Tarzan. You Tarzan? No? Must be Jane.” Cuttlefish and squid communicate using a remarkable ability to control the pigment in their skin. They flash messages in colorful spots, splotches and background color. Cuttlefish add to this unique visual communication certain swimming postures and gestures of their ten tentacles. Along with octopuses, cuttlefish and squid belong to the class Cephalopoda, molluscs related to snails and slugs and clams. Cephalopods, mental giants of the mollusc world, manipulate objects with tentacles, swim with jet propulsion, eat with beaks and see with eyes as complex as ours.

Direct connections from the brains of cephalopods to special muscles allow split-second changes in skin color by relaxing or contracting chromatophores. These skin-surface cells, filled with red, yellow and black pigments, can change from spread out to tightly contracted in a few thousandths of a second. Under the surface layer, white pigment cells and even deeper green cells reflect light when unmasked by contracted chromatophores. Cephalopods can also change their skin texture to enhance communication raising or smoothing warty-looking bumps. Even though cephalopods appear unable to see colors, they seem to match their surroundings remarkably well.

When not fading into the background, some squid and cuttlefish can create dramatic patterns covering either the whole body or only parts of it. In some species, observers have catalogued 31 full-body patterns and calculated a potential repertoire of nearly 300 combinations of full-body patterns, partial-body patterns, skin texture and body posture.

Octopuses remain solitary except when mating, and researchers have so far seen little they would call complex communication. But like squids and cuttlefish, they do exhibit color changes based on internal physiological states. Males of some octopus species sport enlarged suckers, used in a “sucker display,” presumably designed to communicate their sex. And females of one species develop luminescent cells, circling their beaks like green lipstick, that may attract males. Jane cuttlefish—like females of any species—won’t be satisfied with just any male. She wants a healthy, vigorous Tarzan who’s sperm will carry genes that enhance her offspring’s chance to survive, mature and breed again. So she looks for a number of attributes. Size signifies health, of course, but in addition, cuttlefish and squid who swim with their arms erect and their skins flashing apparently look healthy to females.

Cuttlefish and squid make great food—not just as sushi, but to several oceanic predators—so they normally blend into the background with a mottled, cryptic color scheme. But for the male cuttlefish, when it comes to mating the chance of passing on his genes outweighs the risk of becoming a meal.

Stretching his arms forward, bunched together or arched into a ten-stranded basket, he flashes a striking zebra pattern, signaling his sex. Other cuttlefish nearby get the message. Males return the salute, but females remain mottled. The absence of the male pattern, rather than any distinguishing features of the female’s pattern, tells the male her sex. If a male fails to respond with a zebra pattern—perhaps because of illness—other males may mistake him for a female.

All the males in a group strut their stuff with a zebra pattern. But if a nearby female changes from her cryptic mottled pattern to a more

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uniform gray, she's signaling her readiness to mate. Now the competition between males grows intense, in some species escalating into physical contact and biting. Finally all the males but one—usually the largest—literally turn tail and retreat, shifting back to the normal, unisex mottled pattern. This behavior resembles the submissive postures of a dog with its tail between its legs.

After discouraging nearby males with his prowess, the winning male turns from aggressive to sensitive. He approaches the female and turns from visual communication to tactile, gently stroking her between eyes and arms. At first she may indicate her alarm by flashing an acute disruptive pattern. The male calms her by blowing water at her and jetting gently away. He approaches again and again until the female accepts him, literally with open arms. If a boorish rival should attempt to intrude, the mating male again flashes Intense Zebra. If he's swimming side by side with the female, he can even display the stripes only on the side of his body facing the intruder, while maintaining a sexually suggestive uniform gray on the side facing the female. At last the pair links arms and begins to mate. Both now adopt the cryptic mottled pattern that attracts least attention.

Squid, which are more social than cuttlefish, also communicate about courtship with skin color. They gather in groups of 10 to 30 individuals, but soon break up into courtship parties consisting of one female and 2 to 5 males. The largest male attempts to guide the female away from other suitors. The couple engages in precopulatory mutual rocking, jetting gently to and fro together. If the male approaches too closely at this point, the female may streak away. The male follows, and this teasing game can continue for up to an hour at high speed, possibly representing an attempt on the female's part to assess the male's health. Male squid use a zebra stripe not unlike the cuttlefish's to ward off other males, but also exhibit a one-sided smooth silver pattern to signify "keep away." The male only displays lateral silver to other males, keeping the side facing the female tuned to a sexually stimulating display.

Squid don't embrace to mate. Instead the male merely tries to attach a small, sticky packet of sperm to the female's body. As he reaches out with the sperm packet, he displays a pulsating pattern of chromatophores. If the packet sticks, the female places it in her seminal receptacle, completing the mating ritual.

The social cephalopods, squids (such as *Sepioteuthis sepioidea*) and cuttlefish, clearly communicate internal states—readiness to mate, sexual identification and the like. Human equivalents might include blushing, stuttering and shy body postures. But might cephalopods communicate more? Some scientists propose that full-body patterns could act as nouns and verbs and small spots and patterns as adjectives and adverb. Body posture and movement could add context. "It could be that if *Sepioteuthis* puts stripe on the side of the body, and then puts golden eyebrows over the top of the eyes, and raises the arms, that it has modified stripe by the golden eyebrows and by the arm raise to mean something more complicated or maybe even different from whatever stripe means by itself," says Jennifer Mather. Mather, a psychologist, studies cephalopod behavior and teaches at the University of Lethbridge, Lethbridge, Alberta. This hypothesis, though intriguing, remains unexplored.

To further explore cephalopod visual communication, Mather and others would like to "speak" their language. By mimicking the visual cues—communicating to the cuttlefish in a sense—researchers could watch for behavior changes and begin to dissect this complex communication and figure out just how much these molluscs are actually saying.

"I would suspect that cephalopods are not going to have a language anything like as complicated as ours by the time we know whether they have a visual language," Mather concludes, "But I suspect we are going to find an interesting communication system when we finally have the time and the energy and the resources to find out."

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