Sea hares outsmart peckish lobsters with sticky opaline

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Sea hares are not the favourite food choice of many marine inhabitants, and it's easy to see why when you find out about the chemical weapons they employ when provoked – namely, two unpalatable secretions, ink and opaline, which they squirt at unsuspecting peckish predators. However, while much is known about the consequences of purple ink secretion, how the whitish and viscous opaline outsmarts a potential predator remains unknown. Charles Derby from Georgia State University, USA, wondered whether opaline could decrease the activity of a predator's sensory system. Along with his colleagues Tiffany Love-Chezem and Juan Aggio, he set out to test the effect of opaline on spiny lobsters, which occasionally try to snack on sea hares.

The investigating trio find that it is opaline's sticky nature, rather than the chemicals present in the opaline, that is responsible for plugging their sense of smell and published their results in *The Journal of Experimental Biology*.

To begin, they extracted the water-soluble fraction of opaline, and although this lacks the amino acids and other chemical attractants that make up opaline, it is nonetheless just as sticky and possesses the physical properties of opaline. The team then painted this sticky, water-soluble fraction onto the tips of the lobsters' antennules, which act as the lobster's 'nose' and are important for motivation and ability to feed upon smelling a delicious treat. The trio then presented them with tasty smelling 'shrimp juice' and measured electrical activity in both chemosensory and motor neurons. Unlike lobsters with clean, gunk-free

antennules, the shrimp juice failed to whet the appetite of opaline-treated lobsters, with the response of chemosensory and motor neurons being significantly reduced.

The team next wondered whether the amino acids present in opaline could also dampen neuronal activity. Mixing together the five most prominent amino acids found in opaline, they again painted the antennules and tempted the lobsters with the scent of shrimp juice. This time, however, the neurons fired robustly in reaction to the delicious shrimpy aroma. When the amino acids were mixed with the sticky substance carboxymethylcellulose, the neuron reactions were again inhibited. Furthermore, carboxymethylcellulose alone also stopped neurons firing. So, it seems that stickiness is the key to blocking neurons and allowing the sea hare to escape as the lobster preens and cleans itself of the gungy opaline.

More information: Love-Chezem, T., Aggio, J. F. and Derby, C. D. (2013). Defense through sensory inactivation: sea hare ink reduces sensory and motor responses of spiny lobsters to food odors. J. Exp. Biol. 216, 1364-1372. jeb.biologists.org/content/216/8/1364.abstract

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