

Chemical vs Visual Perception in Food Choice Ability of *Octopus vulgaris* (Cuvier, 1797)

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Abstract : Cephalopods are considered as a model organism with a rich behavioral repertoire. Sophisticated behaviors were widely studied and described in different species such as *Octopus vulgaris*, who has evolved the largest and more complex nervous system among invertebrates. In *O. vulgaris*, cognitive abilities in problem-solving tasks and learning abilities are associated with long-term memory and spatial memory, mediated by highly developed sensory organs. They are equipped with sophisticated eyes, able to discriminate colors even with a single photoreceptor type, vestibular system, 'lateral line analogue', primitive 'hearing' system and olfactory organs. They can recognize chemical cues either through direct contact with odors sources using suckers or by distance through the olfactory organs. Cephalopods are able to detect widespread waterborne molecules by the olfactory organs. However, many volatile odorant molecules are insoluble or have a very low solubility in water, and must be perceived by direct contact. *O. vulgaris*, equipped with many chemosensory neurons located in their suckers, exhibits a peculiar behavior that can be provocatively described as 'smell by touch'. The aim of this study is to establish the priority given to chemical vs. visual perception in food choice. Materials and methods: Three different types of food (anchovies, clams, and mussels) were used, and all sessions were recorded with a digital camera. During the acclimatization period, Octopuses were exposed to the three types of food to test their natural food preferences. Later, to verify if food preference is maintained, food was provided in transparent screw-jars with pierced lids to allow both visual and chemical recognition of the food inside. Subsequently, we tested alternatively octopuses with food in sealed transparent screw-jars and food in blind screw-jars with pierced lids. As a control, we used blind sealed jars with the same lid color to verify a random choice among food types. Results and discussion: During the acclimatization period, *O. vulgaris* shows a higher preference for anchovies (60%) followed by clams (30%), then mussels (10%). After acclimatization, using the transparent and pierced screw jars octopus's food choices resulted in 50-50 between anchovies and clams, avoiding mussels. Later, guided by just visual sense, with transparent but not pierced jars, their food preferences resulted in 100% anchovies. With pierced but not transparent jars their food preference resulted in 100% anchovies as first food choice, the clams as a second food choice result (33.3%). With no possibility to select food, neither by vision nor by chemoreception, the results were 20% anchovies, 20% clams, and 60% mussels. We conclude that *O. vulgaris* uses both chemical and visual senses in an integrative way in food choice, but if we exclude one of them, it appears clear that its food preference relies on chemical sense more than on visual perception.

Keywords : food choice, *Octopus vulgaris*, olfaction, sensory organs, visual sense

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