

To: Karen Thompson  
From: Jack Housley  
Title: Elaborating on Octopus Thought Mechanics  
Date: 9/24/12

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## Memorandum

This memo is describing how octopuses' nervous systems works.

**Audience.** The audience of this technical description has a basic knowledge of an octopus and at least grade school knowledge in biology.

**Purpose.** The purpose of this technical description is to inform and spark fascination of the octopus' thought process to the audience.

**Placement.** The placement of this technical description would be in a brochure at the aquarium. Ideally it would be placed near the octopus display so that visitors would read it while observing the octopus.

### Description of Octopus' nervous system:

Figure1:

Almost all animals have neurons, the fundamental cell for thinking and bodily function. In order for any bodily function to occur, neurons need to command the muscles or tissue to perform their certain function. In animals, mainly vertebrates, the neurons are solely in the spinal cord and brain and send commands through nerves to their respective tissue. Octopuses however, have the neurons centralized in their brain and in their arms(See Figure 1). Their arms hold a majority of their neurons, as much as 2/3 of them.

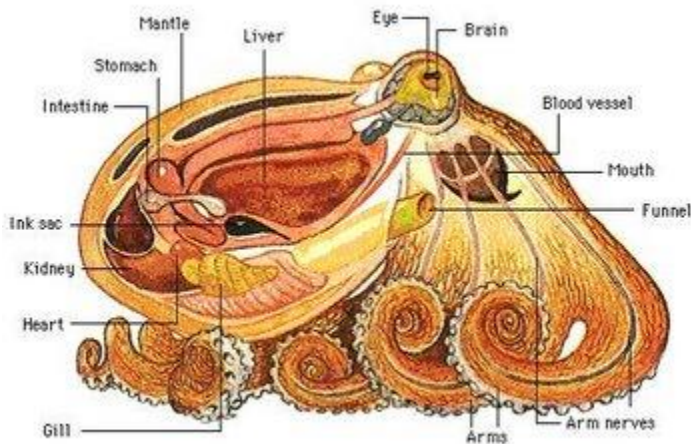


Figure 1

Because of this, 90% of the arm function comes from the arm itself, not the brain. The brain will tell the arm to move, but the neurons in the arm will deal with the specifics of how to move and how to

accomplish what ever task it is given. The neurons also control the suction cups. The arms hold an average of 240 suction cups and use them to grip onto objects as well as taste and touch. Each suction cup can be controlled independently and can grip with considerably force, one of the larger suction cups from a pacific giant octopus can grip with a force 500 pounds. The way the neurons are organized into its arms are key to this creature's success in the wild, the neurons in the arms prevent the brain from being overwhelmed with eights arms of infinite degrees of freedom and independently moving suction cups.

The neurons in the octopuses' brain are where the thinking and problem solving occur. Although only a third of the octopuses' neurons are located in the brain, they are extremely organized and clustered which makes the octopus capable of its remarkable intelligence. The amount of neurons an animal has in its body is measure of intelligence, the octopuses closest relative, the sea slug has 20,000. An octopus has 500 million which is half as many as a house cat and more than any insect, rodent or most fish. This intelligence is evident in their behavior in the wild as well as captivity. In the wild, octopuses are known to imitate poisonous animals, use camouflage to hide, and using coconut shells as protection. In the lab, they display an inquisitive and cheeky nature. Octopuses are able to complete mazes and open jars with latches and locks, and still be able to weeks later, proving they have excellent long term memory. They have also been documented to escape their tanks and squeeze themselves into other tanks and feed on the other fish. Octopuses also show behavior that can be compared to playing. Only the more intelligent animals are known to play. Octopuses have on occasion use their jet to dose their care takers at the aquarium and use it to propel toys through the water.