# STRUCTURAL COMPARISON OF CNIDEA PRESENT ON THREE STRUCTURES OF *METRIDIUM SENILE*

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**Abstract**: Previous studies have suggested that feeding tentacles, catch tentacles and acontia threads of Metridium senile differ not only in structure at the eye level, but also in the types of cnidea they possessed. However, specifics regarding these differences had been lacking. I predicted that differences within cnidea types and distribution as each of these three cnidea baring structures are used differently. In a comparative study looking at the feeding tentacles, catch tentacles and acontia threads of three M. senile specimens under a compound scope, four different types were found. All three structures possessed basitrichous isorhiza. Both catch tentacles and acontia threads also had microbasic amastigophore and b-microbasic mastigophores. And only the feeding tentacles had spriocysts.

## Introduction

The processes of natural selection have shaped and molded the world around us and yielded a plethora of physical traits endowed to afford greater fitness to those organisms whom posses them. An organism of particular interest in terms of specialized traits on the northwestern coast is the sea anemone Metridium senile. A small anemone, usually ranging in size from 5-10cm, usually found among high densities of clones, *M. senile* possess two vary different tentacles around their oral disk: regularly displayed feeding tentacles which are thin and numerous, often just over a hundred (Shick, 8) and the more elusive catch tentacles which are less numerous, but longer and more plastic. As an acontiate anemone, *M. senile* also possess one more extrudable process. When disturbed *M. senile* constricts it's column to disgorge many long thin filaments known as acontia threads. What unites these three different structures; feeding tentacles, catch tentacles and acontia is the presence of cnidea.

Perhaps some of the largest and complex biological secretions known Cnidea are the primary synapomorphy of cnidarians. Upon stimulation cnidea discharge by inversion either in the case of nematocysts: boring their way into the flesh of both prey items and predators, often injecting venom, or by the way of spriocysts which adhere to, or rap around. Among anthozoa, any number of 6 different distinct types of cnidea can be found, three of which, including spriocysts are unique to anthozoa. Differences among cnidea of each type do exist.

In the summer of 2004, Pamela Johnson conducted a series of research observations comparing the structural differences among nematocysts found in three different sea anemones, one of which was *M. senile*. What Johnson found was that there was a striking difference between nematocysts found amid the various structures. However, Johnson's research delve little into the exact types of nematocysts found, or the trends in location. Given that the visual morphology of *M. senile's* appendages differ so highly and are seemingly utilized during different circumstances it would seem likely that the cnidea they posses would reflect this specificity in their own morphology. I predict that the cnidea of each of these structures is some how indicative of the appendage they are found and should be consistently different respectively.

## Methods

All specimens of *M. senile* analyzed were harvested from the floating docks comprising the Charleston Marine docks in Charleston, OR and were between 6 and 7cm tall when fully extended. A sharp blade was used to slowly pry *M. senile's* attached foot from the concrete surface of the dock where they were found. Delicacy was necessary as to prevent the specimens from spewing their acontia threads. M. senile primarily reproduces asexually and new individuals are known to arise from tissue left behind as the anemone repositions itself (Sept, 40). Therefore, each specimen was collected from a different dock extension as to avoid accumulating clones. Specimens were transported to a holding tank on the OIMB campus.

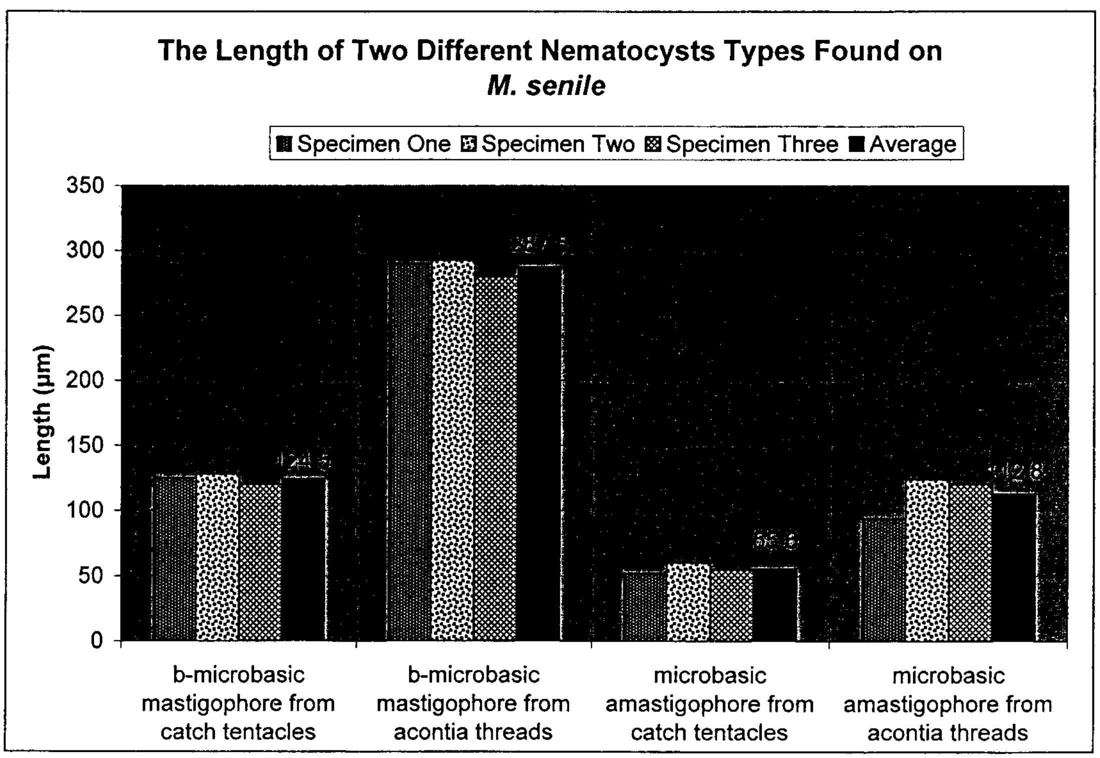
Both feeding and catch tentacles were seize and extended using a pair of laboratory forceps and trimmed at the base of the oral disk with a scalpel. The whole tactical was placed over a clean slide where it was cut once longitudinally and repeatedly laterally with a scalpel. A single drop of 0.1% methylene blue was used to stain and enhance visualization of the cells. A coversheet was placed over the diced tactical. Applying force in concentric circles, the blunt end of an eye-dropper was used to smatter the tactical. Sample sets were fashioned by randomly selecting a portion of the smattered tactical under 100x magnification and counting all capsules within view counted and their respective types noted. Acidic acid was implemented to cause the nematocysts, which hadn't already done so, to fire. Once done, the lengths of all counted b-mastigophores and microbasic amastigophore were measured. All other cnidea lengths were discarded as no apparent difference was observed.

Acontia threads were harvested by exerting pressure on either side of the anemone's stalk with two plastic rulers. Threads were scrapped off the rulers directly onto the slide and the subsequent procedure followed as above.

## RESULTS

After viewing the cnidea of the feeding tentacles, catch tentacles and acontia threads, four nematocyst types were identified (Muscatine, 136) among *M. senile*. Within the feeding tentacles, basitrichous isorhiza and spriocysts were present. Within both catch tentacles and acontia threads, basitrichous isorhiza, microbasic amastigophore and b-microbasic mastigophore types were present. Within each of the three individual *M. senile* samples were taken, ratios of cnidea types were relatively consistent respectively (for complete results view appendix). Under the compound scope only one difference amid any of the cnidea was present. Without fail, both the microbasic amastigophore and b-microbasic mastigophore found on the acontia threads were at least twice as large compared to those found on the catch tentacles (see Table 1).

**Table 1**- The lengths of two different nematocyst types found on *M. senile*. A comparison of the different microbasic amastigophore and b-microbasic mastigophore lengths and each of the three specimens used.



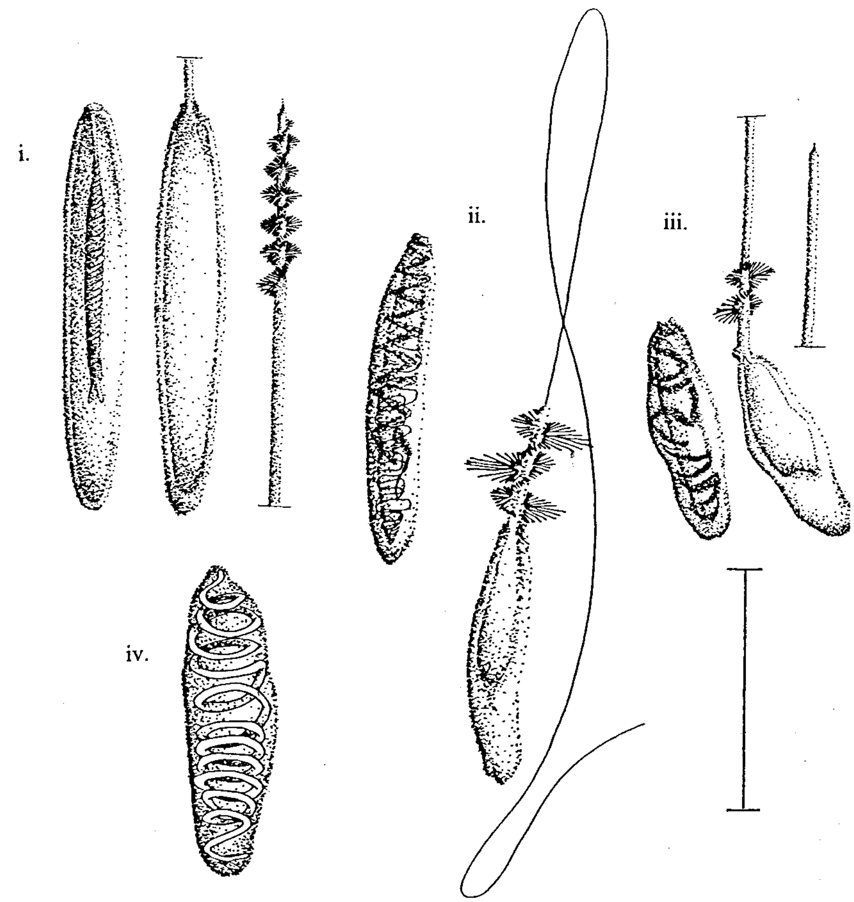



**Figure 1**- All four cnidea types found with three structures of *M. senile*. i) catch tentacle microbasic amastigophore, fired and unfired. ii) catch tentacle b-microbasic mastigophore, fired and unfired. iii) basitrichous isorhiza, fired and unfired. iv) unfired spriocysts. Scale on right side equal to about 12μm.

## Discussion

Variation among the structures of *M. senile* was observed and are anticipated to be present in the nature. However, how do these different cnidea type and morphology contribute and reflect the function of their respective nature? The feeding tentacles of *M. senile* as previously mentioned are much thinner and abundant than the feeding tentacles of many other species of anemone found in this region. It has been speculated that these traits are attributed to a filter feeding lifestyle which specializes in particularly small prey which would flow through wider tentacles (Shick, 14). One of the roles nematocysts play in prey capture is to subdue the prey from thrashing and potentially damaging the anemone. In the case of such small prey stuff with little ability to fight back and high risk of flowing passed the tentacles, simply ensuring a firm hold on the prey rather than subduing the prey with resource consuming venoms may be more cost effective to the anemone. This explanation might explain why the feeding tentacles had such a high quantity of spriocysts and only had basitrichous isorhiza, which are relatively small and thought to typically not contain venom (Edmunds et. al., 941).

In the highly congested environment *M. senile* creates considering it's effortless parthenogenesis, intraspecific competition for space becomes high. As described by Shick 280, "Catch tentacles are exploit [only] in fighting with conspecific and other anthozoans... The tip of the catch tentacle breaks off and remains attached to the 'victim'." Shick goes on to explain that these encounters are rarely fatal. Nor would we expect them to be. How advantageous would it be to kill your genetic equal? This might explain why *M. senile* contain smaller, less damaging microbasic amastigophore and b-microbasic mastigophores among their catch tentacles.

As I first became aware when harvesting *M. senile*, acontia threads are discharged with even very slight pressure to the column. But why? Seeing the threads are not in any way anchored to the anemone, it seems an unlikely method of prey capture. Also, there has been no documented incidences of *M. senile* discharging their acontia threads in response to another anthozoan (Kramer et. al., 134). The acontia threads seem target specific against and have perhaps co-evolved with *Aeolidia papillosa. A. papillosa* is a major predator of many anemone species and is known actually maintain and express the anemones' cnidea through a process known as cleptocnidea. However, studies suggest the larger microbasic amastigophore and b-microbasic to be perhaps fatal (Edmunds et. al., 946). *A. papillosa* are still known to prey on *M. senile* however. I would be curious what kinds of cnidea are expressed by *A. papillosa* in the wild and if this expression reveals any kind of food preference.

## References

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| | type | ave. number | ave. length |
|---|---|---|---|
| specimen one | | | |
| feeding tentacle | b-microbasic mastigophore | 0 | na |
| | microbasic amastigophore | 0 | na |
| | basitrichous isorhiza | 78 | na |
| | spirocyst | 105 | na |
| catch tentacle | b-microbasic mastigophore | 54 | 125 |
| | microbasic amastigophore | 66 | 52 |
| | basitrichous isorhiza | 30 | na |
| | spirocyst | 0 | na |
| acontia thread | b-microbasic mastigophore | 63 | 290 |
| | microbasic amastigophore | 66 | 94 |
| | basitrichous isorhiza | 18 | na |
| | spirocyst | 0 | na |
| specimen two | | | |
| feeding tentacle | b-microbasic mastigophore | 0 | na |
| | microbasic amastigophore | 0 | na |
| | basitrichous isorhiza | 63 | na |
| | spirocyst | 60 | na |
| catch tentacle | b-microbasic mastigophore | 75 | 128 |
| | microbasic amastigophore | 65 | 60 |
| | basitrichous isorhiza | 36 | na |
| | spirocyst | 0 | na |
| acontia thread | b-microbasic mastigophore | 69 | 292.5 |
| | microbasic amastigophore | 75 | 124 |
| | basitrichous isorhiza | 42 | na |
| | spirocyst | 0 | na |
| specimen three | | | |
| feeding tentacle | b-microbasic mastigophore | 0 | na |
| | microbasic amastigophore | 0 | na |
| | basitrichous isorhiza | 19 | na |
| | spirocyst | 32 | na |
| catch tentacle | b-microbasic mastigophore | 75 | 120.5 |
| | microbasic amastigophore | 72 | 55 |
| | basitrichous isorhiza | 51 | |
| | spirocyst | 0 | |
| acontia thread | b-microbasic mastigophore | 81 | 280 |
| | microbasic amastigophore | 74 | 120.5 |
| | basitrichous isorhiza | 39 | na |
| | spirocyst | 0 | na |

appendix