An Examination regarding the Phylogenetic Position of *Vampyroteuthis infernalis*

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**INTRODUCTION**

**Vampire squid:**

*Vampyroteuthis infernalis,* or the Vampire Squid, is a cephalopod found deep in the ocean. It has 8 arms connected by a webbing or "cape," and is typically black in color with red eyes. These attributes led to it being called a vampire (not because it drinks blood). This species exhibits traits that appear in both octopus and squid families which results in a one-of-a-kind organism. However, the phylogenetic position of *V. infernalis* has yet to be truly defined. Some researchers believe that it aligns better with squids while others side with its closeness to octopuses. Therefore, the purpose of this examination, into the phylogeny of the Vampire Squid, is to see if a definitive relationship can be elucidated.

- It has a small set of fins, 8 octopod-like arms, and squid-like reduced shell (a pen).

**Octopus:**

Octopods are cephalopods characterized by a large round head and a mantle, along with eight arms. Each arm has rows of sensory suckers that aid in perception and prey capture. Octopus are divided into two subgroups, Cirrata and Incirrata

- Incirrate octopods comprise about 85% of all octopodan species. They share most traits in common with Cirrates, with a few notable differences-- They have no fins, and no shell.
- Cirrate octopods are unusual in structure and shape. They are usually more gelatinous and have a smaller mantle opening. However, the most distinct difference is the fact that they have fins and a shell structure.

**Squid:**

Squids are also cephalopods, though they have a triangular head. Squids can have between 6-10 tentacles with suckers, but unlike octopods, squids also have hooks at the end of their arms.

- Squids characteristically have two fins as well as an internalized and reduced shell called a pen.

**METHODS**

- Research included 43 in-class taxa with one additional in-class outgroup.
- Cross examination of two genes was implemented (H3 and Ribosomal 28s genes).
- Individual gene processing was accomplished utilizing Phylogeny.fr wherein: alignment of data was processed by MUSCLE, curation by Gblocks, Phylogeny analysis by PhyML + aLRT, and initial tree rendering by TreeDyn.
- SequenceMatrix was employed to combine the aligned gene sequences.
- Final tree rendering was obtained through Figtree v1.4.4

**RESULTS**

- *Vampyroteuthis infernalis,* "the living fossil" is found nested in-between the suborder Cirrata (Octopuses) and the Order Oegopsida (squid) while exhibiting characteristics of both.
- This data shows *V. infernalis* as being contained within the monophyletic supergroup Octopodiformes.
- We can also note the increased evolutionary distance between *V. infernalis* and squids as opposed to their closeness in previous research.

**CONCLUSIONS**

- *Vampyroteuthis infernalis,* according to our analysis, is more closely related to octopuses than it is to squid.
- Moreover, *Stauroteuthis syrtensis,* a member of the suborder Cirrata, appears as the closest relative of *V. infernalis.* Its position, relative to our "living fossil," supports that the Vampire squid is more closely related to the suborder Cirrata (octopuses) than the more distant: Incirrata (octopuses) or the farthest: order Oegopsida (squid).
- Morphological analysis shows that the fins and circe, retained by members of Cirrata and Oegopsida are similar to that of the Vampire squid. However, our examination of the H3 and 28s genes helps to support the above phylogenetic position of *V. infernalis* in conjunction with its similar morphological characteristics.

**REFERENCES**

- Rambaut, Andrew (2008-2010) FigTree: Tree Figure Drawing Tool. Institute of Evolutionary Biology, University of Edinburgh