“Himitsu namekuji” – the Secret Slug(s): 3D-Reconstruction of Aitengidae

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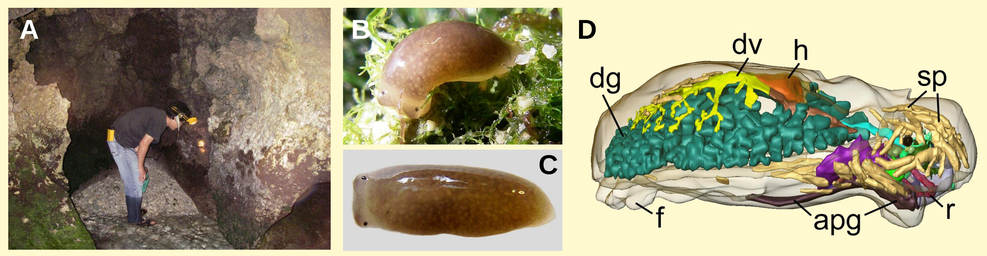
INTRODUCTION

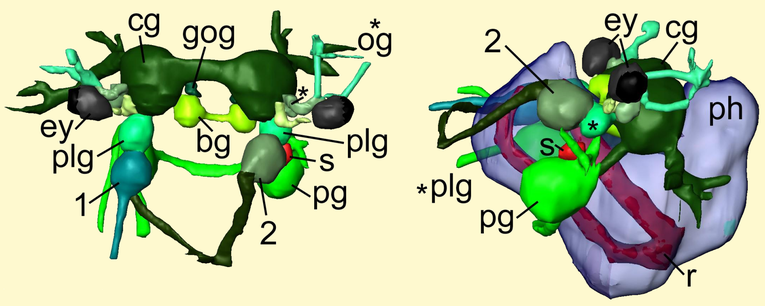
The amphibious sea slug *Aiteng ater* Swennen & Buatip, 2009 was recently described from Thailand - a mysterious ”Bug-Eating Slug” with a worm-like body shape lacking any cephalic tentacles or body processes. It was included into the Top 10 list of bizarre new animal species by the International Institute of Species Exploration at Arizona State University. Anatomically it shows an unusual mix of sacoglossan and acochlidian characters, however, the systematic affinities remained open.

The present study deals with an undescribed, equally tiny and vermiform Aitengidae species - the ”Secret Slug” from the Okinawa Archipelago in Japan. These slugs inhabit intertidal rocky shores with fully marine water and overhanging beach rock. They are common inside caverns and can also be found on the beach rock. They appear only at night between the algae while they hide themselves in small voids in the calcareous rock during the day. One specimen is 3-dimensionally reconstructed based on serial histological sections using AMIRA software. The results are compared with a paratype of *Aiteng ater*.



A: Coastal cavern on Miyako Island, Okinawa, Japan (24˚49`49`` N, 125˚16`42`` E). **B,C:** Living specimens. **D:** 3D-reconstruction of the “Secret Slug“ (right view). **apg**, anterior pedal gland; **dg**, digestive gland; **dv**, dorsal vessel; **f**, foot; **h**, heart; **r**, radula; **sp**, spicule cavity.

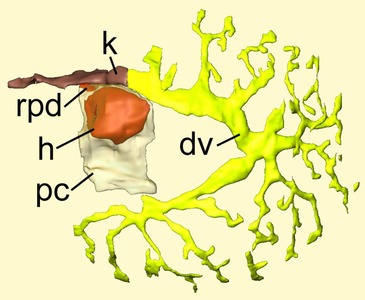
CENTRAL NERVOUS SYSTEM



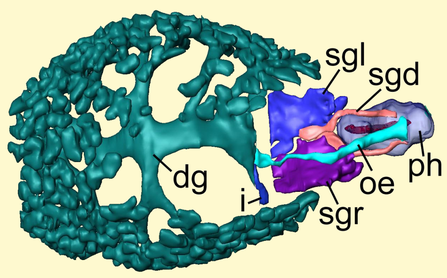
3D-reconstruction of the central nervous system (dorsal and right view). bg, buccal ganglion; **cg**, cerebral ganglion; **ey**, eye; **gog**, gastro-oesophageal ganglion; **og**, optic ganglion; **pg**, pedal ganglion; **ph**, pharynx; **plg**, pleural ganglion; **r**, radula; **s**, statocyst; **1**,**2**, ganglia on visceral nerve cord.

EXCRETORY AND CIRCULATORY SYSTEMS

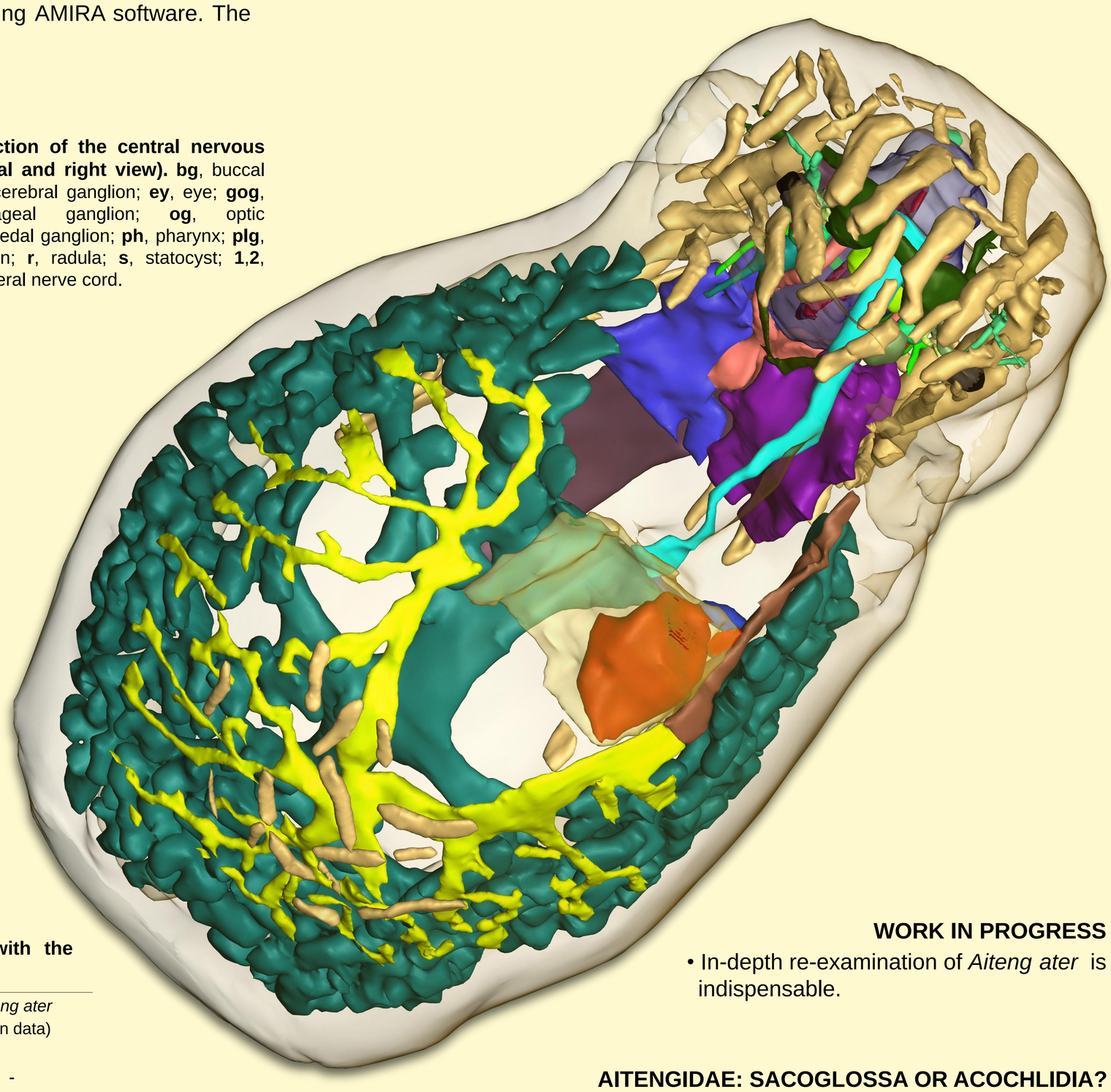
3D-reconstruction of the excretory and circulatory systems (dorsal view). dv, dorsal vessel; **h**, heart; **k**, kidney; **pc**, pericardium; **rpd**, renopericardioduct.



DIGESTIVE SYSTEM



3D-reconstruction of the digestive system (dorsal view). dg, digestive gland; **oe**, oesophagus; **i**, intestine; **ph**, pharynx; **sgd**, salivary gland duct; **sgl**, left salivary gland; **sgr**, right salivary gland.



Comparison of characteristic sacoglossan and acochlidian features with the “Secret Slug“ and *Aiteng ater*. + present; – absent.

	Sacoglossa (*Platyhedyle*)	Acochlidia	“Secret Slug“	*Aiteng ater* (own data)
Free, elongated visceral hump	- (+)	+	-	-
Calcareous spicules	- (+)	+	+	+
Fused cerebro-pleural ganglia	+	-	-	-
Prepharyngeal nerve ring	-	+	+	+
Ramified digestive gland	+ (-)	+/-	+	+
Sacoglossan-like ascus	+	-	-	-
Dorsal vessels	+/-	-	+	+

MAIN RESULTS

The “Secret Slug“ has

- separated cerebral and pleural ganglia
- a prominent rhachidian tooth
- a radula with an ascending and a descending limb; the latter is slightly longer than the ascending limb, and terminately bend upwards
- calcareous spicules in the whole body; they are densely distributed in the head
- a system of dorsal vessels
- a ramified digestive gland

In contrast to the original description, our brief re-examination of the paratype of *Aiteng ater* indicates:

- the absence of fused cerebro-pleural ganglia
- the absence of a sacoglossan-like ascus
- spicule cavities in the connective tissue

WORK IN PROGRESS

- In-depth re-examination of *Aiteng ater* is indispensable.

AITENGIDAE: SACOGLOSSA OR ACOCHLIDIA?

- The “Secret Slug“ shows no major anatomical differences to *Aiteng ater*.
- The Aitengidae resemble acochlidians by possessing a prepharyngeal nerve ring, calcareous spicules and a radula with an ascending and a descending limb lacking a sacoglossan-like ascus. The prominent rhachidian tooth and the well-developed, laterally situated eyes are closely similar to those of limnic Acochlidiidae.
- The uniseriate radula and the ramified digestive gland are characteristic for sacoglossans and certain acochlidian species.
- Affinities to Sacoglossa are suggested by the absence of cephalic tentacles and by the presence of an elysiid-like system of dorsal vessels, with still unknown function and homology.
- In our recent molecular analysis Aitengidae cluster within Acochlidia.
- This would, however, imply that Aitengidae have lost the most characteristic acochlidian apomorphy, the subdivision of the body into a head-foot complex and a free, elongated visceral hump.

REFERENCE

Swennen C & Buatip S 2009: *Aiteng ater*, new genus, new species, an amphibious and insectivorous sea slug that is difficult to classify (Mollusca: Gastropoda: Opisthobranchia: Sacoglossa (?): Aitengidae, new family). *The Raffles Bulletin of Zoology* **57**(2): 495-500.

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