

Looking inside a brooding brittle star

Jannes Landschoff tells us how he used microCT to research reproduction of a marine invertebrate

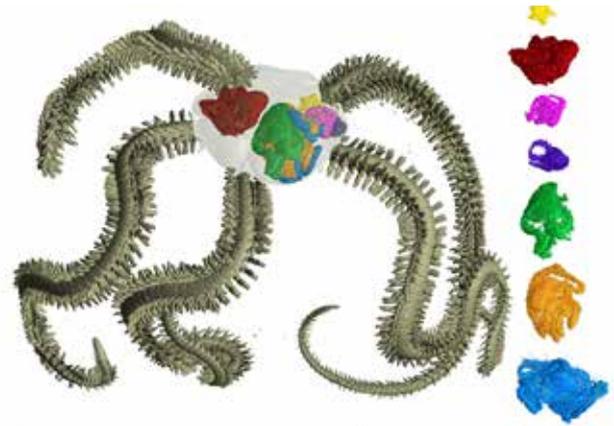
Brittle stars are echinoderms in the class Ophiuroidea. They consist of a central disc and five long, thin arms that can break quite easily – hence the name! Although not as well known as their cousins the starfishes (class Asteroidea), brittle stars are widespread in the marine environment, occurring from very shallow waters down to the deepest depths of the ocean. More than 2 200 species are recognised in the world, of which about 140 occur in South Africa.

Normally, brittle stars release their eggs and sperm into the water, where they are externally fertilised and then develop as tiny larvae in the plankton. This method is called broadcast spawning. However, about 5% of all brittle star species actively brood their young in specialised pouches called ‘bursae’. This behaviour has long fascinated biologists. It is remarkable that an animal without a centralised brain, and with one opening to the stomach that serves both as the mouth and the anus, is capable of such a complex reproductive behaviour, similar to that of humans.

The young brittle stars stay inside the mother for an extended period, potentially up to a year. During this time they need to be nurtured and fed by the mother. Previously it was not entirely clear how the young brittle stars lie within the mother’s bursae – to see them inside, biologists would have to cut the specimen open. This would destroy the brood pouch, changing the position and orientation of the young in the process.

MicroCT scanning has helped to visualise the internal brooding of brittle stars, as this non-invasive technique can produce *in situ* images of the young in their natural position. There are usually 10 brood pouches in a brooding brittle star. The serpent-skinned brittle star *Ophioderma wahlbergii*, which is common in the coastal waters of Cape Town, was found to brood up to 33 young at a time, and different developmental stages could be seen in different brood pouches.

It was also previously hypothesised that the young are fed by the mother secreting nutrients through the bursal body wall. This would mean that these animals are ‘truly viviparous’, giving birth to live young that were nourished and developed inside the parent’s body. Some research suggests that bacterial activity at the surface of this body wall helps the young gain sufficient food. The young would therefore be expected to press their mouths against that surface, but this could never be verified.



A brittle star with seven young, artificially coloured to show their size and position. © Jannes Landschoff

MicroCT scans have now shown that most young would indeed be positioned with their mouth against the wall, but not all. Especially when they occur with other siblings in the same brood pouch, they are often stacked on top of each other. The siblings inside may well fight for the best positions and compete for the available food sources. What remains unknown is how much the young actually move around inside. Perhaps by scanning living organisms, microCT imaging could help to solve this mystery in the future.

A two-minute video animation of microCT images of a brooding brittle star is available on YouTube. Search for Brittle Star [2014].

Young brittle stars poke their arms through their mother’s bursal slits, getting a taste of the underwater world that awaits them.

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