

Animal or plant? In most cases this would seem to be an easy question to answer, by applying the most basic of distinctions: plants gain energy from the sun by photosynthesis, animals gain energy by eating plants (herbivores) or other animals (carnivores). However there is a suite of animals that blur the boundaries, by incorporating plant cells within their tissues and gaining sustenance from their sun-loving tenants.

Most examples of this practise, known as 'symbiosis', are from the marine environment, with corals perhaps the most well-known. Corals incorporate photosynthetic single-celled algae of the dinoflagellate genus *Symbiodinium*. Coral bleaching, that unfortunate but now common malaise brought on by extended periods of elevated sea temperatures, is in fact due to the coral expelling its symbiotic dinoflagellates. As well as corals, symbiotic dinoflagellates occur in molluscs such as giant clams, jellyfish, sea anemones, sponges and flatworms.

Another group of herbivorous animals gain benefit from algal partners in a slightly different way, perhaps best regarded as midway between symbiosis and predation. These herbivores don't incorporate whole cells, but rather retain the functional chloroplasts (the subcellular organelle responsible for photosynthesis) within their bodies. This rare phenomenon is known as 'kleptoplasty' (from 'klepto', the Greek word for thief); it has been documented in several single-celled marine organisms including foraminifera, dinoflagellates and ciliates. Kleptoplasty in multicellular animals, however, is known only in a group of herbivorous sea slugs belonging to the Sacoglossa, more commonly known as the 'sap-sucking sea slugs'. These slugs feed primarily on green seaweeds, and retain the functional chloroplasts within their bodies for varying periods of time. They use a specialised feeding apparatus to pierce the wall of the seaweed and suck out the contents. Studies measuring chloroplast activity have shown that they do not remain functional indefinitely. In some species, the chloroplasts are rapidly digested and show no photosynthetic activity. In others, the



Caliphylla, the green thief

chloroplasts do remain functional, usually for less than two weeks but in some cases for over 10 weeks, although there is a slow decline in activity over that time.

The benefit to the sea slug is most likely nutritional; it will use the products of photosynthesis released from the chloroplasts, or store the plastids for future consumption when food sources may be limited. However, an additional benefit may be camouflage. Being the same colour as seaweed is certainly an excellent way to remain hidden from potential predators and these slugs are rarely seen.

Recently, WA Herbarium curator John Huisman was snorkelling at Cape Peron, south of Perth, collecting photos of seaweeds to contribute to DBCA's FloraBase. One species caught his eye, a green seaweed by the name of *Bryopsis foliosa* growing on the seagrass *Amphibolis antarctica*. While examining the seaweed back in the laboratory, something unusual happened; some of the branches started to move! On closer inspection the mobile seaweed turned out to be a sacoglossan slug which, judging by its colour, had been feeding happily on the *Bryopsis*. While it went unnoticed at the time it was collected, the slug can be seen in the photograph

Above *Bryopsis foliosa* with the extremely well-camouflaged *Caliphylla* near the base (arrow).

Inset The sap-sucking slug *Caliphylla*.
Photos – John Huisman

of the seaweed (arrow). The focus of the discovery then shifted and photos of the slug were sent to the Western Australian Museum, where staff excitedly contacted Dr Pat Krug at Cal State L.A., who works on this group. Pat identified the slug as a species of *Caliphylla*, a name that translates to 'beautiful leaf'. There is currently only one species of this genus known – *Caliphylla mediterranea*, described originally from Naples, Italy, but subsequently recorded from the Atlantic Ocean and Mediterranean Sea. The genus has apparently never been formally recorded in Australia, and further study of the Cape Peron specimen is underway to ascertain whether it is one of several recently documented but undescribed species from the Pacific, or yet another new *Caliphylla* species. Discoveries such as this are entirely serendipitous, but show the value of keeping a watchful eye and seeing beyond the obvious.