

Rainbow Warriors

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Amorphous and incandescent sea slugs are the mini-marvels of the deep. What's more, many have superpowers, and they're not afraid to use them.

By Ashley Hay

On some of the beaches that mark Australia's east coast you'll find a delicate purple shell resembling an iris that's petrified and shattered – sometimes one petal-shaped fragment; sometimes an almost-complete cone of flower. I've been seeing them, collecting them, bringing them home for more than 30 years now, little bits of luminousness that might have escaped from Van Gogh's famous painting, and yet it's never occurred to me to ask what they're called, where they come from, how they're broken into fragile little shards.

It's the same with bluebottles stranded on the sand (although I no longer stomp on them to hear the crack of their bubble bursting), the crabs scuttling across rocks, the slugs easing their slow way along swimming-pool walls. I've spent my life seeing them and, although I'm an innately curious person, supposedly trained, now, to ask the what and the how of things, it's never occurred to me to find out why sometimes there are slugs and sometimes not, or what kind of crabs they might be – although I know that these stories must exist, tended and amended by a population that spans from neighbourhood naturalists to marine biologists, people who know better than the careless rest of us that they are there for the asking.

Even about bluebottles, the potentially painful punctuation of any swim, I have only the vaguest information: one summer you were advised to pour hot water on the sting; another summer, it was a can of coke. But it's never occurred to me ask their name, where they come from, what they eat – or what eats them.

It's an exquisite thing, *Glaucus atlanticus* – a cyanophile's dream of deep blue starbursts and stripes, an amalgam of chrysanthemum and candy-cane. Backlit on Bill Rudman's computer monitor, the screen brightly modern in an office of teetering papers and tall filing cabinets, it's breathtaking.

He clicks through the images: the *Glaucus*' smoothly blue relative *Glaucilla marginata*, and then another more surreal photo, of *Glaucus*, below the water's surface, its tentacles stretching towards a bluebottle's dangerous string. This is the thing that eats bluebottles – not only extracting nutrients from them but also storing the worst of those stings at the end of its own digestive glands (or cerata) to use for its own protection. It's like a character in a computer game that can kill its enemies and absorb their superpowers.

"You can get a much worse sting from those than from the bluebottles," says Rudman, clicking on through the pictures – a red and yellow *Gymnodoris*, a stripy black-white-yellow *Chromodoris* with its orange horns and tail, a velvety green *Elysia*. It looks a bit leafy, this last creature, and is, as Rudman surprisingly explains, solar-powered. "There are creatures that take up [single-celled plants called] zooxanthellae and photosynthesise with them," he says, "while others, totally unrelated, can take chloroplasts from the algae they're feeding on and keep

that alive in their tissues. The interesting thing is that there's not enough genetic material left in the chloroplast to give [the animal] the instructions it needs to photosynthesise. It needs something from the nucleus to trigger what's going on." Quite recently, says Rudman, someone worked out that "the animals have taken genetic material from the plants and incorporated it in their own nuclei." He pauses. "The slugs are doing their own genetic engineering."

Rudman is a retired malacologist – a student of molluscs – and one of the numerous "honorary researchers" whose post-retirement work continues to uncover incalculable knowledge. These creatures he's showing me, telling me about, are all nudibranchs – sea slugs, or soft-bodied snails, of which there are more than 3000 species known around the world. The focus of Rudman's professional life for the past 40 years, his questions about what they look like, where they live, what they eat, how they evolve have led him from a Bachelor of Science at the University of Auckland through various countries to this crowded office at the Australian Museum, where he first arrived in 1978. Curiosity about the natural world was "a childhood thing," he says; "I've always been interested in natural history, everything to start with but I ended up with mainly beach stuff. I had bottles of preserved octopus and sea-horses and things under my bed ... I think my mum was secretly proud of it; sometimes I'd come home and she'd been showing it to all of her friends. I knew I was going to be a biologist from very early on."

Despite that, Rudman had no plan to study sea slugs – "they're just so difficult to identify" – until he reached Fiji in 1971, on a post-doctoral grant. "When you start finding them, you think, 'well, there must be some way to sort this out.'" And so he began. He worked in India. He worked in Bristol. He worked in Tanzania and Zanzibar.

"I'd always wanted to go to Zanzibar," he says, "but it was just after a revolution ... a bit scary, but more like a Graham Greene novel. The president used to go round in this old Morris Oxford, and you were supposed to stand to attention when the car went past – because the car behind it was full of guys with machine guns. The problem was his car looked like every other broken-down car in the place ..."

What Zanzibar represented, in sea-slug terms, was the location of "some of the earliest work done on nudibranchs in the west Pacific, in 1910, 1912: Charles Eliot [an administrator of British East Africa] was interested in nudibranchs, as a gentleman naturalist. He had other people collecting specimens and then he'd write up the papers about their basic anatomy." This was the way of much amassing in the 18th, 19th, and early 20th centuries – gentlemen funded professional collectors, sometimes trekked out to make their own collections, or sat in comfortable studies receiving contributions sent by interested and generous amateurs.

In the 21st century, as science – situated mainly in universities, defined by funding that's simultaneously decreasing in size and increasing in competitiveness – has moved further away from its roots in curiosity, in hobby, Rudman has created an interesting new version of these old networks. Under the auspices of the Australian Museum's website, he's established the Sea Slug Forum (www.seaslugforum.net), an interactive repository of information, images, questions and suggestions that has a quarter of a million visitors to its pages every month and is rumoured to be Australia's most popular scientific site. (Rudman demurs.) From four messages a week in 1997 ("and I was very pleased when we got something like that"), the forum has spawned a

network of professional researchers and enthusiastic amateurs – particularly divers and underwater photographers – in the immediacy of cyberspace, creating what Rudman describes as “a sort of international field-trip, that never stops”. In the world’s waters now, he has “thousands of pairs of eyes, making observations” from more than 140 countries.

All of which means that Rudman’s own curiosity and knowledge are suddenly plugged into areas of the world where little had been known about what was there and what it was doing – from East Timor and Croatia, from Greece and parts of Russia, from Guatemala and “quite a number of parts of South America”. Reports of species’ distributions are changing almost daily: “we seem to be finding new natural geographic regions which we never really suspected before; we thought of the western Indian Ocean as being a very discrete area, but it looks like that region extends right around India, to Thailand.” Basic questions are being answered – Rudman had been trying for 20 years to find out what one family of slugs ate “without any luck,” but a series of observations posted on the forum provided the answer and “we could tick that whole genus off”. New species are being identified, classified and named.

Sea slugs are not what many people think of as being beautiful – although once you’ve seen one, there’s no question of their brilliance. But that brilliance, and often their existence, is pretty precarious: for one thing, if you don’t know how to preserve them properly, you end up with specimens that look like pre-chewed pieces of chewing gum. For another, their habitats can be precarious, whole populations washed out of existence by the kind of heavy rainfall everyone apart from malacologists would be thrilled to see coming down.

But the secret, as Rudman knows, is that these slugs, like everything in the natural world, are extraordinary, and endlessly intriguing – once you begin to look at them. “I don’t think you ever dull to it. If I’m in the field, if I’m in the Museum and doing something that’s exciting, I always rush along and find someone to tell; I don’t think you ever lose that.”

What he also understands is that there’s a “huge natural constituency of people out there interested in things like this – interested in natural history.” He sees it in the popularity of people like David Attenborough – “he’s not just a great communicator ... his topics are of interest to most human beings” – and events like Australian Museum open days: “you can put anything under a microscope, and kids will love it.”

Most children, he trusts, are still curious about their world, just as he was when he made his way along New Zealand’s beaches. The problem is that they don’t take their curiosity to places that will give them feedback. It’s one of the strengths of the forum, and something that’s struck a cord with hundreds of divers: “People don’t want to dive aimlessly, just as they don’t want to walk around the streets aimlessly. Once you’ve done the shark thing, the reef thing, well ...” He pauses. “But with the forum, there’s purpose to what you’re doing; you’re enjoying it and you know that it can be very valuable too.”

Spend an afternoon talking with Rudman about his slugs, his science, and you understand that it’s not only the extinction of nudibranch species that concerns him. His very discipline – taxonomy, or the classification and naming of the world’s animals, vegetables and minerals – is under threat, still a painstaking process of compare-

and-contrast analysis even in the fast and connected 21st-century world. “It’s very time-consuming,” he concedes. “People say, ‘why don’t you just describe that new species?’ Well, even if you did nothing else, it could take a couple of months just to do the anatomy ... then you’ve got to do the bookwork, check that it *is* a new species, even in groups that you’re very familiar with.”

It’s not a job you can hurry, nor a job that you can take up after a speedy bit of training – “it’s a lifelong commitment,” he says, “you’re learning all the time”. And it’s not a job that looks very sexy beside the kind of projects Rudman calls “gee-whiz” science, the nifty, cutting-edge stuff that tends to attract not only dollars but headlines.

“Perhaps no one knows what a desperate state taxonomy is in,” he suggests, “but there are so few of us around the world now ...” He pauses, leans forward slightly. “Then again,” he says, “all science is fighting for its life – that’s the way it looks to me. The things scientists have to go through to get funds now; when anyone finds a gene they say is going to cure something ...” he shakes his head. “For one thing, they don’t know if it is going to cure it, and for another, what are they going to do? Make a little microinjector to put it in everyone’s cell?” He shrugs, gestures towards the *Elysia*: “Maybe we should ask this little slug how it gets its plant genes into its nucleus ...”

At 61, Bill Rudman retired “some time in 2005”. But he’s still working in the fascinating chasm between how much has been understood and quantified of one little piece of the planet’s fauna and everything still unknown, his won research fitting around maintenance of the forum – and answering the 10 or so queries that arrive there each day.

He opens a filing cabinet almost at random. “I’ve got a number of half-finished projects – this drawer is the family *Gymnodoris* which is carnivorous – in the sense that they eat other nudibranchs. This,” another drawer, “is some stuff I almost finished – that was six years ago. This,” another row of folders and papers, “is the to-do drawer just on one genus ... and usually when you do discover something, it just opens up more interesting things to go looking for. You never say, ‘that’s the end’.”

Weeks later, he emails to tell me the pictures for this story are ready and we arrange to meet the next day. At the end of the message, that irrepressible curiosity: “I think the iris-like purple shells you’re collecting are segments of a cone-shaped barnacle shell. If you have a bit, bring it in – I can have a look.”