Symbiosis
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Stories of Symbiosis

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Abstract The *Small Friends* book series was presented by the Australian art-science collaborative 'Scale Free Network' (SFN) at the Teaching Symbiosis session of the 2015 International Symbiosis Society congress in Lisbon, Portugal. The books tell stories about symbiotic relationships between microbes and larger forms of life – presenting an opportunity for researchers of different symbioses to share their findings with the world, one story at a time.

Keywords Symbiosis · Book · Education · Art

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Presented at the 8th Congress of the International Symbiosis Society, July 12–18, 2015, Lisbon, Portugal.

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Interactions between microbes and eukaryotes occur in all ecological niches, with a wide spectrum of associations. However, mutualistic symbiotic relationships involving microbes remain greatly underrepresented in education and science media. This denies the public an opportunity to appreciate the fundamental role that microbes play through their (mostly) beneficial partnerships in nature. As a consequence, people tend to overwhelmingly associate microbes – particularly bacteria and viruses – with disease and death, resulting in misguided approaches to agriculture, medicine, hygiene and more. The long-term goal is to educate people about the significance of symbiosis as an important driving force for evolution. Each storybook is also a kind of symbiosis – an intimate collaboration between artists, writers, educators and scientists.

Through the narrative of the story, complex global concepts and phenomena are conveyed alongside microscopic and molecular interactions, woven together as part of an unfolding adventure. The final section of each storybook includes a glossary and additional scientific explanations – providing diagrams, photographs, micrographs and further descriptions for readers (both children and adults) who wish to dig deeper into the mechanisms behind the symbiosis.

The picture book format also offers the use of artistic license – assigning gender to bacteria, allowing them to speak, and even narrate the story from their perspective. These devices help readers to connect with and empathise with the tiny protagonists. The scientific integrity of each book is extremely important.

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Fig. 1 The Squid, the Vibrio & the Moon - cover artwork by Aviva Reed

The book creation team is currently comprised of Ailsa Wild (writer), Aviva Reed (illustrator), Briony Barr (SFN art director) and Gregory Crocetti (SFN science director), with Linda Blackall (microbiologist) regularly providing scientific guidance during the production of each book. In addition, each story is developed with feedback from school students, teachers and science communicators.

The first book in the Small Friends series is *The Squid*, *the Vibrio* & *the Moon* (Fig. 1), released in 2014. This book was created to tell the story of the relationship between the Hawaiian Bobtail squid and bioluminescent bacteria *Vibrio fischeri*, in consultation with the McFall-Ngai laboratory. The story is split into two parts – with each part narrated from the perspective of the individual symbiotic partners – both with the same luminous finale. The second book, *Zobi and the Zoox* (Fig. 2) was released in 2015, and is set inside a single coral polyp on the Great Barrier Reef. The story was inspired by recent research at the Australian Institute of Marine Science into the exchanging of zooxanthellae by corals as an adaptation to rising seawater temperatures and it also describes the role of rhizobia bacteria in fixing

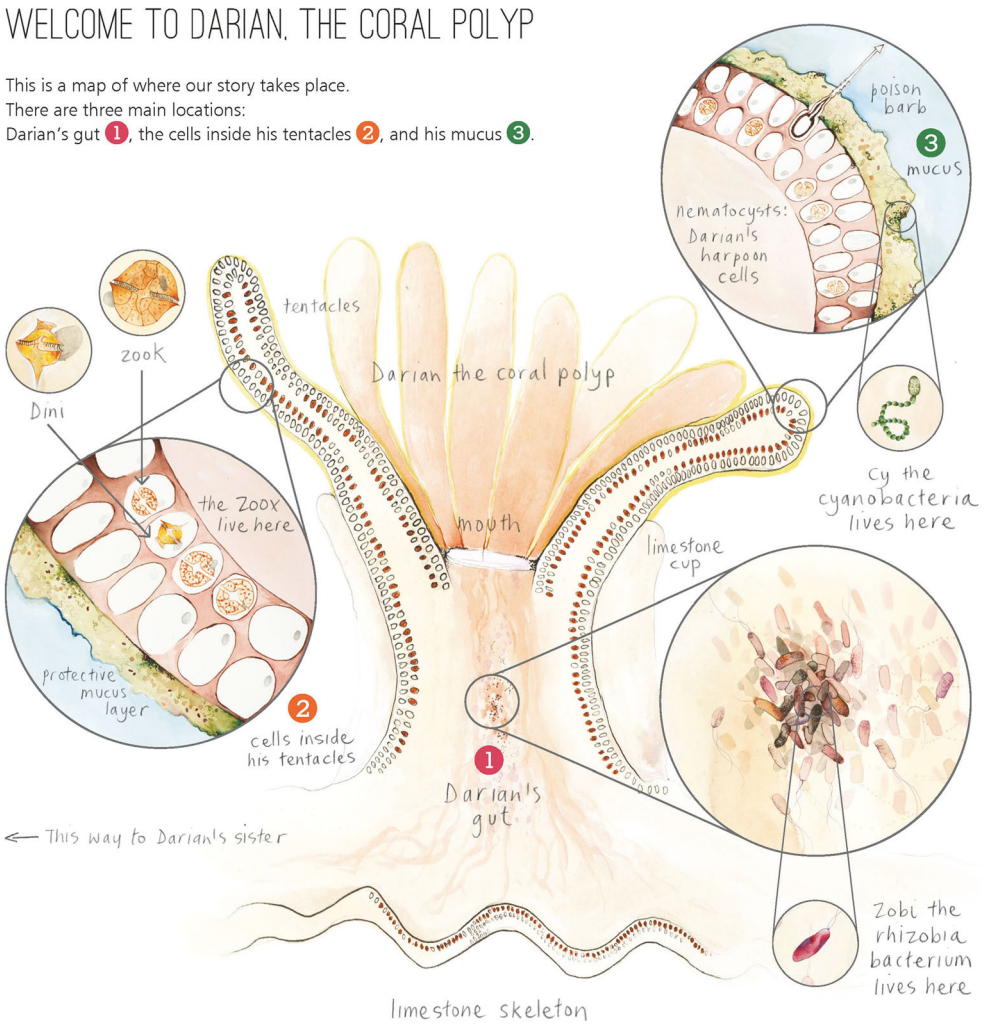

Fig. 2 Introduction to characters and setting from the book - Zobi and the Zoox. Artwork by Aviva Reed and Briony Barr

nitrogen for corals. A third book is being developed in collaboration with researchers from the Institut Pasteur and San Diego State University, for release in early 2016.

Future storybooks will investigate symbiotic partnerships between: plants and mycorrhizae; termites and their complex gut communities; aphids and their defensive bacteria; *Azolla* water ferns and their photosynthetic cyanobacteria; insect pathogenic nematodes and their bacteria; *Elysia* sea slugs and their plastids; lichen and their photobionts etc. Those interested in participating to develop new stories are invited to contact Scale Free Network at collaborate@scalefreenetwork.com.au or visit www.smallfriendsbooks.com.