



Encyclopedia of Life

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## Sea Slug Podcast and Scientist Interview

### *Elysia chlorotica*

Journey to Tampa Bay, Florida, where scientist Skip Pierce and one of his students first made a remarkable discovery twenty years ago. Meet *Elysia chlorotica*, a bright green, solar-powered, algae-slurping sea slug that's still turning our understanding of the classification of life upside down.

#### Transcript

**Ari:** For the Encyclopedia of Life, I'm Ari Daniel Shapiro. And this is: One Species at a Time.

There was a moment, 30 years ago, that changed the direction and focus of Skip Pierce's career. He's a biologist at the University of South Florida, and he spends his summers at a lab in Woods Hole, Massachusetts.

**Pierce:** This student walked into my lab with this little green sea slug. And I said, "Where the hell did you get that?" And she said, "Well, right out here in the mill pond, you know?" And I mean, I'd been working here for 15 years or so, and I'd never seen it at all. Nor had anybody else that's worked at the lab. And I thought, "Well, that's weird."

**Ari:** Weird – first of all – because of where it was found.

Pierce: It lived in a place where sea slugs shouldn't be – namely this pond that's subjected to rain and tides and heat and ice and everything else in the winter – because slugs have no external protection. They're just sittin' out there in the environment.

**Ari:** And weird – second of all – because...

**Pierce:** It was just a bright, deep green color.

**Ari:** Make no mistake, these sea slugs – or *Elysia chlorotica* – they've definitely got those basic slug-like characteristics...

**Pierce:** You know, it moves slow, doesn't think much, covered with mucus. A sea slug is a snail without a shell, basically.

**Ari:** But I should also mention, they're stunning. They're delicate and soft. Their common name is Eastern emerald elysia.

**Pierce:** *Elysia* comes from the Elysian fields of Greek mythology, which are sort of green, lovely fields.

**Ari:** Their resemblance to little green leaves isn't just accidental.

**Pierce:** The deal is that the animals only eat particular species of algae, called *Vaucheria litorea*.

**Ari:** *Vaucheria litorea* forms a mat of tiny green tubes, or filaments.

**Pierce:** A sea slug, it punches a little hole in the side of the algal filament, and then it sucks out the contents exactly as if it was a soda straw.

**Ari:** The *elysia* slurps up the algae's innards, including its chloroplasts. That's where photosynthesis takes place, which is how plants (like algae) use sunlight to convert carbon dioxide into the food they need to grow.

**Pierce:** And those chloroplasts are maintained inside the, the sea slug for months. And they photosynthesize while they're in there. So if you shine light on the sea slug, it makes oxygen, and it fixes carbon dioxide, exactly as if it was a plant. After it gets its initial supply of chloroplasts, it can complete its entire life cycle simply on photosynthesis. And that's – I mean that in itself is sort of surprising, but not nearly as surprising as finding in the slug DNA...algal DNA. I mean, that's the trick to this whole business.

**Ari:** The trick, that is, to keeping the algae's chloroplasts up and running inside the sea slug.

**Pierce:** The slug is using those genes to make proteins that the chloroplast needs – I mean it's just an astonishing display of biochemistry.

**Ari:** So, how did the slug get the algal DNA?

**Pierce:** Uh – and that's the thousand-dollar question, or maybe million-dollar question.

**Ari:** The *elysia* are born with the algal DNA. At first, Pierce thought that sometime in the past, the algal DNA got transferred to an ancestral sea slug...by a kind of virus called a retrovirus.

**Pierce:** Retroviruses are capable of moving small pieces of DNA around from organism to organism.

**Ari:** But the virus didn't just insert algal DNA into the sea slug.

**Pierce:** That virus resides in the DNA of the slug.

**Ari:** So the sea slug has sea slug DNA, it has algae DNA, and it's got viral DNA.

**Pierce:** Yep, DNA is very complicated business.

**Ari:** The sea slugs live for about 10 months. Then somehow the viral DNA switches on. When the elysia die, their cells are just riddled with retrovirus.

**Pierce:** Whether or not those viruses cause the slug's death, we don't know, but the slug's just falling apart right before your eyes over a period of a few days. And they get all ragged on the edges, and I mean – they just look – you think, "Oh, man, the poor thing."

**Ari:** But Pierce came to realize that the viruses couldn't be responsible for transferring all the algal DNA into the sea slug.

**Pierce:** Initially, I sort of naively thought there was only a couple of genes that were transferred. And that's of course stupid. I mean, a virus could do one or two or three genes, maybe, but not dozens...or hundreds.

**Ari:** Pierce still doesn't know how this animal became part plant and part virus factory. It's just the latest puzzle in a series that began almost three decades ago when his student showed Pierce that sea slug for the first time. But he's hopeful that the eastern emerald elysia may teach us about our own DNA. About how to do genetic engineering and how to treat human disease with gene therapy. All that inside this astonishing little leafy creature.

**Ari:** Visit [eol.org](http://eol.org) to hear how Skip Pierce captures the sea slugs he needs in his lab.

**Pierce:** I mean, you should see the looks we get out when we're slogging around in that marsh, with hipboots on and a bunch of turkey basters and Ziploc bags.

**Ari:** Our series, One Species at a Time, is produced by Atlantic Public Media in Woods Hole, Massachusetts. I'm Ari Daniel Shapiro.

## Meet the Scientist

Meet Dr. Sidney Pierce, the scientist featured in the Sea Slugs podcast:



**Where do you work?**

Department of Integrative Biology, University of South Florida.

**What do you study?**

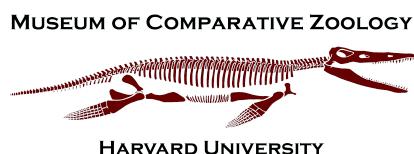
I am a cell biologist/biochemist trying to figure out first principles about how life works.

**What are three titles you would give yourself?**

Biologist, teacher, mentor.

**What do you like most about science?**

The challenge of answering a significant question.



The One Species at a Time podcast series is supported by the Harvard Museum of Comparative Zoology.