

[MUSIC PLAYING]

STEVE PALUMBI: Corals are small animals. But they build structures that you could actually see from space. As we zoom in, we see the reefs where I work, on a little island called Ofu on American Samoa. The ridge there, the edge, is the coral reef. And as we zoom in, we see what those reefs are.

Now, the reefs are made of individual coral colonies, like we see now. That coral then is actually made up of a whole series of small polyps, they're called. This is a colonial organism.

And the polyps themselves have all the structures that an animal needs. It has a mouth. It has tentacles. It has gonads.

It can live. It can reproduce. It can grow. They're in a colony of genetically identical polyps.

Now, the color on these tentacles, like I said, is not the color of the coral itself. It's the color of the symbiont. And as the focus racks in and out a little bit here, then what we see is that we can just see the little globules of the symbiont. Well, let's take a closer look. We'll go into a tentacle and see those.

These cells, the symbionts, are not just floating around. They're actually inside the coral cells. Corals are simple. They just have two cell layers, an epidermis and a gastrodermis inside. The symbionts are inside the gastrodermis. And you can see it there.

Now, this is in a life form called a dinoflagellate. It has chloroplasts because this coral is synthetic. But it has a very odd-shaped chloroplasts, like these yellow structures here.

We're going to zoom in to the chloroplast itself because that's where the damage happens during bleaching. What a chloroplast has in them, they have membranes called thylakoid membranes. Those membranes hold the proteins, called photosystems, that then capture light energy and turn it into chemical energy.

It's the molecules that turn all of the sunlight that we get on the planet into the food that we eat. The rain of photons down here hits these photosystems and they gather them up. Now, if the temperature goes up and if the light goes up, then they freak out. There's too much energy. The photosystems break. And they no longer can function the way they do.

But the rain of photons keeps going. The energy is still there. And as a consequence, that energy is now turned into reactive oxygen molecules. Those are damaging to cells.

So it damages the inside of the symbiont. It damages the inside of the coral cell and they spit the symbiont out. That spitting of the symbiont out by one coral cell is bad. But if the entire colony does it, then that's coral bleaching.

What you can see here is simulated of the spitting out of these symbionts and the gradual whitening of this particular part of this particular coral colony. Well, when that happens across an entire colony, then the coral turns from its normal tan color into a white color. What difference does that make? The symbiont provides 75% to 80% of the energy the coral needs to survive. And without that energy, it can't make a skeleton and it can't live very long. So as a consequence, a lot of the corals that bleach eventually die.

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