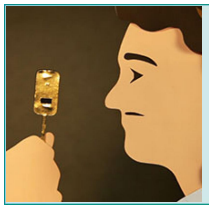

Animated Life: Seeing the Invisible

hhmi | BioInteractive

Transcript
Short Film

[CRICKETS CHIRPING] [MUSIC STING]

[GENTLE MUSIC PLAYING]

[CRICKETS CHIRPING]

[Voice of Bonnie Bassler, Princeton University]

BONNIE BASSLER: Everything that you can actually see with your eye is just the smallest sliver of life on this Earth. Most of life is invisible.

[Animated Life: Seeing the Invisible]

BONNIE BASSLER: We still have this idea that we're the most central feature of Earth, and it's the humans that are the bystanders. The microbes are doing the work.

[Delft, the Netherlands, 1673]

DOUGLAS ANDERSON: [SPEAKING DUTCH]

[Voice of Douglas Anderson, Medaille College]

What do you do when you see things that no one has ever seen before? L-A-Y— lay-- U-- ven-- they pronounce it with a V-- hoek, Leeuwenhoek.

[Voice of Lodewijk Palm, Utrecht University]

LODEWIJK PALM: Antonie van Leeuwenhoek. He was a haberdasher in the city of Delft in the Netherlands.

DOUGLAS ANDERSON: And why his curiosity found an outlet in microscopes, that is just lost to history. We really don't know.

LODEWIJK PALM: The quality of his microscope was superb. He made some 500 of these small instruments, and only a few of them he showed to visitors. He never told anyone how he made his lenses.

DOUGLAS ANDERSON: Robert Hooke in England, he wrote this wonderful book, Micrographia.

LODEWIJK PALM: The first observations of the small world with lenses.

DOUGLAS ANDERSON: One of the first things that Leeuwenhoek did was look at things that Hooke had looked at. There was a stinger of a bee, leg, I believe, of a louse—the singular of lice. But he saw some things that Hooke didn't see because his lenses were better.

[“Diertgens,” 1674]

[FROGS, BIRDS CALLING]

[WHIMSICAL MUSIC PLAYING]

DOUGLAS ANDERSON: It was summertime. It was August. The days were so long that you'd get a lot of algae growth on water. He called it green clouds. Curious again, he has what he calls a glass vessel, a jar, probably, and he filled it with the water. The next day, he put it under his lens, and what he saw was green streaks.

Among this was all these little animals.

[*Daphnia* sp.]

DOUGLAS ANDERSON: And these things were a whole lot smaller, like a thousand times smaller, than anything he had ever seen before.

[*Filinia longiseta*]

[*Cyclidium sp*.]

[*Vorticella sp*.]

DOUGLAS ANDERSON: And I think the line is, "I confess I could not but wonder at it." [LAUGHS]

[WHIMSICAL MUSIC PLAYING]

[*Euglypha sp*.]

[*Philodina roseola*]

LODEWIJK PALM: Leeuwenhoek called them, in Dutch, [SPEAKING DUTCH] And [SPEAKING DUTCH], that's a diminutive of the word "dier"—

[*Amoeba sp*.]

DOUGLAS ANDERSON: Dier, D-I-E-R.

LODEWIJK PALM: —which is the Dutch word for "animal."

DOUGLAS ANDERSON: What Leeuwenhoek called them was "little animals."

LODEWIJK PALM: This was all so new. The word "microorganism" did not exist at the time. The word "bacteria" is from the 19th century.

[*Fragilaria sp*.]

DOUGLAS ANDERSON: And that strikes me as Adam in the Garden of Eden, who, in Genesis, named all the animals.

[*Asterionella sp*.]

DOUGLAS ANDERSON: It was just a brand-new world, and he was the first person in it.

[*Meridion sp*.]

LODEWIJK PALM: He wrote a letter to the Royal Society, one of the first organizations to practice experimental science.

DOUGLAS ANDERSON: And they were going, oh, my heavens. What is this?

LODEWIJK PALM: At first, they didn't believe it.

DOUGLAS ANDERSON: Finally, the other members of the Royal Society were also able to see it. And the rest is history.

LODEWIJK PALM: And so he discovered many things—

DOUGLAS ANDERSON: Sperm, red blood cells, protozoa, and bacteria.

LODEWIJK PALM: —which nobody had ever seen before.

DOUGLAS ANDERSON: He is the first person to see everything he looked at for 50 years.

BONNIE BASSLER: Van Leeuwenhoek wanted to see these things. Well, he saw them. But now we get most of life is microbial. If you look at the tree of life, only this tiny little part is every single thing you've seen.

[Visible life]

[An Unknown World: Microbes Today]

BONNIE BASSLER: Every higher organism is covered, inside and out, with bacteria. And humans would not be alive if these little 24/7 partners weren't giving us all of these genes and proteins that our own genomes don't encode. And they have all kinds of fabulous behaviors.

[*Vibrio harveyi*]

BONNIE BASSLER: Vibrio harveyi, it's a marine bacterium that looks like a sausage, and it's very fast. "Vibrio" means vibrate. And what is amazing is that if one watches them go from a single cell to a number of cells, all of the bacteria in unison start glowing in the dark.

By studying this bioluminescent organism, we discovered that bacteria can communicate using a molecular language. We used to think that social behaviors were the purview of higher organisms. What we now understand is that bacteria were probably the first organisms on this earth to ever communicate with one another.

We're always looking at an unknown world. We're driven by our ignorance, and we're driven by the idea that the world must be more complex than what we understand right now. And that's enough inspiration to do an experiment.

[WHIMSICAL MUSIC PLAYING]

Can you imagine being the first one to see a sperm swimming around? I mean, that'd be a scary thing, right? [LAUGHS]

[WHIMSICAL MUSIC PLAYING]