0:00:00.000,0:00:09.160

I had this daydream about a pair of

bored aliens surveyors whose job it is

0:00:09.160,0:00:15.240

to go out in the universe and catalog

planets that have life and I was

0:00:15.240,0:00:21.949

imagining that they picked earth and the

reason that they picked earth is that it

0:00:21.949,0:00:29.990

has oxygen in the atmosphere. And a

steady amount of 21%. And that would be

0:00:29.990,0:00:36.309

meaningful because oxygen is really

reactive and unless you have something

0:00:36.309,0:00:42.620

making oxygen. Oxygen in the atmosphere

is going to disappear. So I think that

0:00:42.620,0:00:48.940

would be the reason that they pick earth

to come in survey. And I picture these

0:00:48.940,0:00:56.920

kind of jaded space travelers checking

out the planet and categorizing what

0:00:56.920,0:01:00.170

they find here. They've seen it all

before.

0:01:00.170,0:01:05.700

What might they find interesting? And I

think what they'd find interesting was

0:01:05.700,0:01:12.380

that there were all these things that we

call plants, and all these things that we

0:01:12.380,0:01:20.009

call animals but at core they really are

0:01:20.009,0:01:26.869

elaborations of something that our cells

contain and those are the organelles

0:01:26.869,0:01:35.380

called chloroplast and mitochondria and these

are tremendously important and

0:01:35.380,0:01:43.540

interesting intracellular entities. Part

of the reason they're so fascinating is

0:01:43.540,0:01:53.990

is that they're really visitors in our

cells. They are bacteria sized, and they

0:01:53.990,0:01:59.880

have their own DNA and while our

chromosomes are in our nucleus they have

0:01:59.880,0:02:04.950

it inside the little mitochondria and

chloroplasts and they actually in

0:02:04.950,0:02:12.819

cooperation with ourselves make copies

of themselves. So they are our

0:02:12.819,0:02:19.879

guests and they are essential guests in our

cells now with the chloroplasts do is

0:02:19.879,0:02:26.799

take sunlight energy and make sugars and

oxygen so they are the source of our

0:02:26.799,0:02:33.810

atmospheric oxygen that's at a stable

level and when you look at the equation

0:02:33.810,0:02:40.450

for photosynthesis you see the inputs

and outputs and what's fascinating is

0:02:40.450,0:02:47.579

that we have in all animals the

intracellular mitochondria. The

0:02:47.579,0:02:53.849

powerhouse of the cell they call them.

And these have their own DNA too and

0:02:53.849,0:03:01.639

they are using exactly what

photosynthesis makes. We need the sugars

0:03:01.639,0:03:09.269

and the oxygen and the energy that's in

the sugars in order to support our cells

0:03:09.269,0:03:14.400

in our lives. And all animals are the

same that way everybody's got

0:03:14.400,0:03:24.500

mitochondria. And plants have both chloroplasts

and mitochondria. And it's

0:03:24.500,0:03:30.509

fascinating to think about when you

think of a human and the systems that we

0:03:30.509,0:03:38.030

have the respiratory system and the

circulatory system the heart and the

0:03:38.030,0:03:44.949

vessels in the digestive system. What

are they there for. They're there

0:03:44.949,0:03:51.939

ultimately just because we have

mitochondria and we take in the oxygen

0:03:51.939,0:03:57.040

and we take in the food and there's no

place else we can use this stuff to make

0:03:57.040,0:04:05.739

energy except in these little packets

inside all our cells that convert those

0:04:05.739,0:04:13.359

sugars using oxygen into the energy that

we need to survive. We're built around

0:04:13.359,0:04:20.079

the presence of these tiny ancient

organelles.