0:00:00.000,0:00:06.450

What gives molecules their shape and how

to shape relate to function?

0:00:06.450,0:00:13.690

Water is of very peculiar substance. What

makes it so odd. Where does the energy that

0:00:13.690,0:00:18.609

we use to maintain life come from?

0:00:18.609,0:00:24.170

Think about these three chemicals:

caffeine from coffee, nicotine from

0:00:24.170,0:00:32.219

tobacco and opium from the opium poppy.

These plant substances have profound

0:00:32.219,0:00:36.399

effects in the human body. Why is that?

0:00:36.399,0:00:42.500

And the simple answer is that shapes

determined function. Each of these

0:00:42.500,0:00:48.579

molecules interacts with different

molecules in our body mainly receptor

0:00:48.579,0:00:55.660

proteins and by doing so they alter our

physiology. But they have to fit together

0:00:55.660,0:01:04.769

in order to have that function. The shape

of a molecule is determined by the

0:01:04.769,0:01:11.799

elements it's made of and how those

elements are connected to each other. The

0:01:11.799,0:01:19.530

way in which molecules are made is by

chemical bonds and chemical bonds are

0:01:19.530,0:01:29.619

made by electrons. In these cases the

sharing of pairs of electrons. Molecular

0:01:29.619,0:01:34.600

shape can be altered and there's two

important ways that this can occur

0:01:34.600,0:01:43.070

Molecules can be altered in shape by the

environment or by the instructions the

0:01:43.070,0:01:49.689

genes that make those molecules. Think

about a fever.

0:01:49.689,0:01:53.180

Why is it that very high fevers can be

fatal?

0:01:53.180,0:02:00.590

Very high fevers that temperature change

an environmental change can change the

0:02:00.590,0:02:07.229

shape of molecules that we absolutely

required to live. In terms of genetic

0:02:07.229,0:02:13.240

changes, it's the instructions for making

the molecule that are

0:02:13.240,0:02:19.640

altered and those result in a molecule

that has a different shape and most

0:02:19.640,0:02:29.510

often can't complete the normal function.

Water is a peculiar molecule. Nothing else

0:02:29.510,0:02:31.760

that you can think of

0:02:31.760,0:02:38.070

behaves like water does. And waters

peculiar properties come from the way

0:02:38.070,0:02:44.450

that it's built the hydrogen and oxygen

and are bonded together by shared pairs

0:02:44.450,0:02:51.360

of electrons a so-called polar

covalent bond and that is the reason

0:02:51.360,0:02:57.460

that water has these very strange

properties. You can't think of anything

0:02:57.460,0:03:04.150

else in which the solid form of a

substance floats on the liquid form. It

0:03:04.150,0:03:08.470

just doesn't happen. And all of it

revolves around the way that these

0:03:08.470,0:03:16.860

electrons are shared. Think about what

you ate for breakfast today. Those food

0:03:16.860,0:03:23.090

molecules are inside you now being

digested and absorbed molecules are

0:03:23.090,0:03:29.550

being transported inside your cells and

inside your mitochondria those molecules

0:03:29.550,0:03:36.190

are being ripped apart. And what the

purpose of that tearing apart of

0:03:36.190,0:03:44.080

molecules is to extract the energy and

the energy that you extract from food is

0:03:44.080,0:03:51.210

the electron energy. Step back for a

second where did that electron energy

0:03:51.210,0:03:52.130

come from?

0:03:52.130,0:03:57.160

Well in the ecosystems that we encounter

most often it comes from sunlight energy.

0:03:57.160,0:04:05.050

So that the chloroplast in plants takes

light energy and energizes electrons and

0:04:05.050,0:04:11.459

uses those electrons to make things like

sugar and carbohydrates. We eat those

0:04:11.459,0:04:18.180

molecules and inside our cells the

mitochondria is the place where we rip

0:04:18.180,0:04:24.790

apart those bonds extract those

electrons and gain the energy we need to

0:04:24.790,0:04:31.010

maintain life from those very molecules

those very electrons that had been

0:04:31.010,0:04:37.900

energized by sunlight. So it is electrons

that determine the shape of molecules

0:04:37.900,0:04:42.980

and that shape determines their function

it is electrons that determine the

0:04:42.980,0:04:48.000

property of substances like water in

which life flourishes and it is

0:04:48.000,0:04:53.750

electrons that are the source of energy

that maintains life.