What is DNA?

DNA is a molecule found in the cells of all living things, and it carries the instructions that tell our bodies how to grow, develop, and function. It looks like a twisted ladder, and the steps of the ladder are made of special chemical codes. These codes determine traits like your eye color, hair type, and even how your body fights off sickness.

0:00 *Video montage of plants growing out of the ground, flowers blooming, cells under a microscope, flock of birds in the air, and jellyfish underwater.*	We all probably feel intuitively that we know what make makes life different but pinning it down precisely is actually very difficult indeed. And in what follows I'm going to describe four key qualities that all living things seem to possess.
0:23 *Video of green plant cells followed by white text over various images of cells. followed by video of leafy green plants on a farm, ending with a video of a panda eating bamboo in a forest.*	All living organisms are made from cells, all cells can metabolize, and what we mean by that is that they can take in energy and materials from the outside world in order to maintain themselves and keep themselves going.
0:48 *Blue screen with black rectangles. Helix made up of 1s and 0s with white writing on the left. See through image of a human body in blue showing internal bones and major organs in red with writing in white on the left. Thermal camera video of a dog in red. Video of a human's skin sweating.*	Now this complicated process is governed by instructions that are contained in the master molecule DNA. That's deoxyribonucleic acid that is present in all cells. The second quality we call homeostasis, by homeostasis we mean the ability of all cells, and in fact, all living organisms to keep constantly adjusting to tiny changes in their environment using the energy and materials they get through metabolism.
1:20 *Black and white video of a cell reproducing under a microscope with white text over top. Video of orange cells reproducing and splitting. Video of a chameleon on a stick with white text over top.*	The third crucial quality is reproduction. However good they are at homeostasis eventually all cells, all living organisms, break down and die. Before it dies it can make copies of itself and its DNA and scatter those copies around it. The fourth quality we call adaptation over many generations' species can slowly change and adapt and diversify as environments change.
1:48 *Video of a strand of DNA splitting followed by a video orange and blue fish near a coral reef.*	The way they do this is actually strangely through mistakes in the copying of DNA. Just occasionally DNA makes mistakes, but the copy works. And when that happens, and you get a new version that can actually do all these things, it can metabolize, it can do homeostasis, it can reproduce. We say that a new species has been created and that's how we get the huge diversity of life all around us today.

2:15 *Video of computer code on a black screen followed by a video of a white DNA helix with a blue background.*	Well, the best way of thinking about DNA is to think of it as being a bit like the software in your computer. DNA is a vast molecule with billions of atoms in it and they're organized in two great chains.
2:37 *White screen with grey rectangles forming a ladder, the ladder twists to form a double helix, the letters ATGC on the right side of the double helix.*	Each chain has arms, and those arms link up to form like the rungs of a ladder so the whole thing ends up looking like a ladder. Then it twists on itself to form a double helix and that folds up compactly at the center of the cell. This is how it works; the information is contained on the arms of the ladder in a special four-letter code. Molecules inside the cell approach the DNA unzip the crucial part, read off the code, and then go back into the cell and make the proteins necessary to do what the DNA needs it to do. DNA can also copy itself;
3:18 *Grey ladder drops down from the top of the screen with the two sides of the ladder separating, two grey ladders next to each other form, camera zooms out on multiple strands of grey double helixes.*	the two parts of the ladder separate and each of the arms goes off into the sludge of chemicals around it and finds its counterpart until eventually you have two identical double strands of DNA. And that's how DNA copies itself and that's the basis of reproduction in all living organisms.
3:40 *Video of a lab with people in white coats looking at a strand of DNA. Black and white image of Charles Darwin with white text on the right. Second black and white image of Charles Darwin*	DNA is at the center of our modern understanding of how life works. But even in the 19th century the English naturalist Charles Darwin had generated a broad understanding of how these changes occur, of how life evolves. Before Darwin's time most naturalists believed that species were fixed, they didn't change over time.
4:06 *Picture of dinosaur bones in the ground, video of a farmer walking with his sheep, video of a red bird with a large yellow and white tail on a tree.*	But some had studied fossils and that seemed to mean that change, that species actually did change over time. The question was how Darwin knew that animal breeders can actually change species quite quickly within just a few generations and the way they do it is by choosing which individuals will breed and which won't. Now what Darwin noticed is that something very similar seems to happen in the natural world.
4:37 *Animated video of a white eagle on a black screen hunting a mouse.*	Think for example of an eagle, think of an eagle with really good eyesight, it's going to get plenty of food it's going to reproduce. And think of another eagle that has very poor eyesight, it's going to really struggle, and its chances of reproducing are rather poor. So, what this means is that the eagle with really good eyesight is likely to have many more offspring and slowly over time its qualities will become more and more common,

5:00 *Video of a bald eagle standing in a nest in a tree with two baby eagles followed by a video of a hawk standing on a tree.*	and that particular group of birds is going to change and become more like the eagle with good eyesight. This, Darwin realized, is the mechanism that changes life, nature is selecting which individuals will breed.
5:15 *Black and white photo of a diagram of a pidgin skull followed by a video of a spinning blue double helix with white text over top which zooms out to show a human form.*	He called this mechanism natural selection. Darwin's idea and our modern, coupled with our modern ideas about how DNA works are really the key to understanding life and how it works.