**Professor Mark Chase**

My name is Mark Chase, I'm one of the senior researchers now retired. But I worked at Kew for 27 years.

We’re standing at the corner of the Evolution Garden which was set up to display the diversity of plants. So you get to see all different kinds of things but it's set up based on the phylogenetic... What's it called? The phylogenetic relationships of the plants. And what that means is that we've used genetic information or DNA to look at how plants are related to each other.

And it works out very nicely in fact, because it also reflects the development of their flowers. So we have at one end of the garden things without flowers, and at the other end of the garden we have very complex flowers. And in the middle you have things that are intermediate.

And this was all worked out with DNA information, but it correlates very nicely with the morphology that is, what they look like.

**Dr Ilia Leitch**

Okay, so my name is Ilia Leitch and I'm Assistant Head of the Department of Comparative Plant and Fungal Biology.

Using DNA information has been really exciting because it's really opened our eyes to understand the true evolution relationships between plants.

DNA is a complex molecule that contains all the instructions needed for a plant or for any organism to survive and reproduce. So the code consists of what we would call the ATCG. And it is the order, of those four letters, which conveys the information that gives like a book of instructions so that the organism can survive.

Just as your DNA will be more similar to that of your parents and your siblings that you have, than it will be to your friends because you share a common sort of family tree with your parents and siblings. In the same way, plants which are more closely related have DNA sequences more similar to each other.

And so what we can do is to compare the similarity in the DNA sequence between different plants and say if they're more similar to each other, we use that information to say that they must be more closely related to each other.

And for the Evolution Garden, what you're seeing is the result of our understanding of sequencing DNA from thousands of different plant species, comparing those sequences and then using that to build our family tree of flowering plants so that we can then group them together into those that are most closely related to each other into the different rooms that you can see in the Evolution Garden.

The thing about understanding relationships was that early studies by botanists didn't have the advantage of being able to sequence DNA and so they did group things together based on their appearance or sometimes their chemistry or anatomy but this, as I say, led to misleading understanding of how things were related.

**Professor Mark Chase**

Before we had DNA, we had just morphology and used that to help us develop classifications for the plants but even though we studied the plants very thoroughly, in many cases they still fooled us into thinking that things were related when they weren't and other things we thought were distantly related when in fact, based on the genetics, we know they're closely related.

Things like the lotus *Nelumbo,* which was always considered to be a waterlily because it looks like a waterlily, but with the DNA information we found instead that it's not related to waterlilies but rather related to the plane tree. And that's quite a revolutionary idea.

And I have to say, when we first saw that result come out, we thought we'd mixed up some of the DNA tubes and had to go back and redo it to be sure that we hadn't made a mistake because it seemed just completely preposterous. But now we know that no matter how you look at this situation, genetically, no matter which part of the plant's DNA you look at, you still get the same idea.

So we just have to accept that these are two groups of plants that have gone very different directions and because one's adapted to being a herbaceous water plant and another as a tree that's wind pollinated, that these are going to look completely different. And it's one of those cases where the DNA information allowed us to realise that two things are related that we would never have guessed based on what they look like.

**Dr William Baker**

My name is Bill Baker. I lead one of Kew's science departments, Comparative Plant and Fungal Biology. So most people who come into Kew see us as a wonderful, exotic park full of amazing trees and other plants but actually we're a world-leading plant and fungal science institution with more than 300 scientists beavering away behind the scenes on some of the biggest questions about the survival of plant life on Earth.

Understanding the tree of life is really the ultimate project in biology. We liken it to the periodic table, it's that fundamental. It gives you a roadmap for navigating the properties of life on Earth and that information is absolutely fundamental to how we understand plants and how we see their future, how we can manage their future in the face of global change.

PAFTOL is one of Kew's most ambitious science projects. We are using the latest DNA techniques to build the biggest tree of life for all the plants and fungi, gathering much, much more DNA data than has ever been gathered before and using all the amazing assets that we have at Kew.

It's an incredibly exciting time for the tree of life. We are in the middle of a genomic revolution, that means a revolution in the technology around generating DNA sequences that are bigger and bigger, a bigger scale. We're also seeing computer capacity skyrocketing so we're in a position to do really powerful science.

The collaboration and the future opportunities, many of which we can't even imagine yet, are going to blossom before us in the coming years and decades.