



READ THE FOLLOWING ARTICLE CLIPS BEFORE YOU ANSWER THE NEXT SET OF QUESTIONS.

DNA reveals who's related to who in plants

People have classified plants since prehistoric times. In the past, relationships between plants were assigned largely on the basis of their physical appearance. Today, studies on plant relationships can use DNA information. Many genes are very similar in all plants, and in plant families even the way they are arranged on chromosomes is very similar. Such basic similarities between different species mean that scientists can use DNA data to understand evolution and plant relationships and develop classification techniques and protect biodiversity

Surprise, surprise!

DNA technology has revealed just how deceptive appearances can be. For example, close similarities in flower shape and watery habitat once led botanists to think that waterlilies were closely related to the sacred lotus. They are not. Instead Kew scientists have revealed that the closest relatives of the sacred lotus family include the London plane trees!

African violets.

Researchers at the Royal Botanic Garden Edinburgh are looking at the evolution and development of the Cape Primrose (*Streptocarpus*, *Gesneriaceae*), a common houseplant native to tropical Africa. Many forms can be found, each adapted to living in a different habitat. *Streptocarpus caulescens* has well developed stems, while *Streptocarpus dunnii* has a single, huge leaf which grows throughout the plant's life. Despite looking quite different from African Violets (*Saintpaulia*, *Gesneriaceae*) DNA research has shown that they are actually very closely related.



London plane tree



The sacred lotus



Streptocarpus dunnii



Streptocarpus caulescens

Evidence set 1:

And then there were leaves

All leaves, however different they look, belong to one of only two types. They are either single-veined or web-veined. The fossil evidence and traditional plant classification suggest that leaves in club mosses and other plants evolved separately. But recent research suggests that all plants might use the same mechanism to control leaf formation. What's going on here? Could exactly the same genetic mechanism have evolved twice?

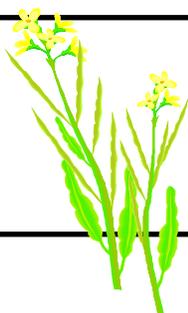
Question 1: If you were a scientist and you had to give an answer to a newspaper reporter, would you say that leaf types had evolved separately, or evolved down one path, or that you weren't sure how they had evolved?

Evidence set 2:

Classification chaos!

As we find out more and more about different species we need to organise all of this data. We already have a great deal of information and some important classification information was even held on card files. There may be data on computer systems in different countries and different research centres.

Question 2: If you were a scientist, what would you do to organise the information so that as many scientists as possible could use it as well?



Evidence set 3:

Cutting the mustard!

Mustard oils are responsible for a peppery, sharp taste and are found in a range of different plants such as horseradish, turnip and broccoli. For many years there was controversy over the relationship between the different plants containing mustard oils because the flower structures of some species were so different from others. Many thought the pawpaw, with its tubular flowers, could not possibly be related to cabbage with its simple four petalled flower. Others argued that the chemical pathway for making mustard oils is so complex that it probably evolved only once – suggesting all plant families with mustard oils are related. The competing classification systems were confusing.

Question 3: What is the problem with working out this relationship just by how plants look?

How could DNA technology be helpful?

How would research scientists be able to “put this DNA to work”?



Evidence set 4:

Cinderella or ugly sisters?

The lady's slipper orchid (*Cypripedium calceolus*) is among Britain's rarest plants, having been reduced to a single plant in the wild.

Question 4: You are a scientist who is on a committee to help to protect and conserve this species. You have been given two plants that look very similar to the lady's slipper orchid that you have already seen.

How can you be sure that they are the same species?

What would you advise if they were the same species? What would you advise if they weren't the same species?