Scientists from the Wellcome Sanger Institute are sequencing the genomes of 25 species found in the UK. This project is the first step in a much bigger project that plans to decode the DNA of all species living in the British Isles – that's a lot of life forms! From the Robin and Golden Eagle to Squirrels, Voles, Otters and Trout, there are a wide range of species being studied.

Every life form has a genome, a set of DNA instructions that make up all living things. DNA sequencing is a method used to decode DNA, taking it from a gloopy substance in a tube and translating it into a sequence of DNA letters. Studying the DNA of different plants, animals and fungi can help us understand how they are adapted to the environments in which they live and how they have evolved over time.

Below is a quick introduction to the 25 species having their DNA decoded for the first time and featuring in the Curious Nature programme. The species have been grouped into five categories; Iconic, Flourishing, Floundering, Dangerous and Cryptic. Find out more below!

## ICONIC

These plants and animals are Iconic to the British Isles.

### **Blackberry** (*Rubus ulmifolius*)

Blackberries are found in hedgerows, parks and gardens all over the UK. There are hundreds of different types, which can be really difficult to tell apart. Millions and millions of Blackberries are grown every year and can be used to make jams and desserts. Understanding the plant's DNA could help fruit farmers breed bigger and tastier blackberries and improve the way they grow this soft fruit.

### **European Robin** (*Erithacus rubecula*)

The robin is a common sight in our gardens and parks and is an iconic British bird, featuring on many Christmas cards and decorations. Like many birds, some robins migrate to warmer countries during the winter months. Sequencing and studying its DNA will help us to understand how these birds navigate using the magneto receptors in their eyes to "see" the Earth's magnetic fields.

## **Lesser Spotted Catshark** (*Scyliorhinus canicula*)

You might not have seen a lesser-spotted catshark but it's likely that you've found mermaid's purses on the beach – these are the shark's egg cases that often wash up from the seabed. Sharks are important for studying how vertebrates (animals with back bones) have evolved over time. Sequencing the sharks DNA will help with this research. The catshark won the public vote to be sequenced in this category.

## **Golden Eagle** (*Aquila chrysaetos*)

The majestic golden eagle has suffered from hunting and pesticide poisoning in the past; it is now a protected species and there are around 500 breeding pairs in the UK. However, to increase their numbers in the wild, breeding programmes are being set up. Sequencing and studying the DNA of eagles will help scientists understand more about the eagles biology but also enable conservationists to pick the right birds for breeding and release into new habitats.

## **Red Mason Bee** (*Osmia rufa*)

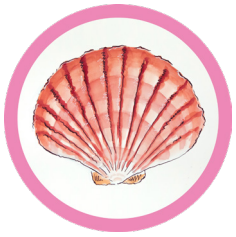
Unlike honey bees and bumble bees, the red mason bee is a solitary bee, living and making nests on its own. It is found in lowland England and Wales. The Mason Bee is an excellent pollinator (actually better than the honey bee), so understanding more about its DNA will be useful especially when comparing it to honey bee DNA which has already been studied.

# DANGEROUS

These species are potentially harmful to humans and other species living in the UK. Many are "invasive" species meaning they are not native or naturally found in the UK and are either killing or taking the place of UK species in different habitats.

## **Asian Hornet** (*Vespa velutina*)

The Asian hornet or yellow legged hornet is found in South East Asia, however it has spread to Europe and scientists are worried it could spread to the UK. The Asian hornet is dangerous because it kills honey bees to feed to its larvae. Honey bees are important pollinators of our crops. If Asian hornets settle in the UK they could destroy our bee population and have a serious impact on beekeeping and agriculture. Genome sequencing will help researchers stay one step ahead of the hornet.



## King Scallop (*Pecten maximus*)

The King Scallop is a type of shellfish that lives in UK waters and is a popular seafood dish. Scallops feed on microscopic algae that floats in the water, however some of these algae produce an acid that can build up inside the scallop. This acid is toxic and can poison humans if eaten. Studying the DNA of the scallop could help us understand more about how the scallop survives the toxic algae.

## Giant Hogweed (*Heracleum mantegazzianum*)

A close relative of cow parsley, giant hogweed was introduced to the UK in the 19th century because of its impressive size. It now out-competes native plants and its sap can cause serious burns if it comes in contact with our skin. Studying its DNA will help to answer questions about how it can grow so big and why it is so toxic.

## Himalayan Balsam (*Impatiens glandulifera*)

Himalayan balsam is a fast-growing and very successful plant species that was introduced to UK gardens in the 19th century. In the summer it produces purplish pink helmet shaped flowers. It has now spread across large areas of the UK and is found around rivers and waterways. It grows to over 2.5 m so shades out other plants meaning they cannot grow. It is now seen as a “problem plant”.

## New Zealand Flatworm (*Arthurdendyus triangulatus*)

The New Zealand flatworm arrived in the UK in the 1960s, probably on imported plants. It is a ribbon-like creature, purple-brown in colour with a white edge around it. The flatworm can grow up to 15 cm long and feeds exclusively on earthworms. Very few animals eat the flatworm so its population has increased in the last few decades. There are concerns that it could have an impact on soil health but also earthworm eating mammals such as badgers and moles.

## CRYPTIC

Species that are out of sight or are unidentifiable from others based on looks alone.

### **Brown Trout** (*Salmo trutta*)

The brown trout is a fish species that takes three forms, the key difference being how and when they migrate. One form of the fish remains local to its birth where it will live out its life, spawn and die. The second migrates from lakes to fresh water rivers to spawn. The third migrates to the sea, only returning to fresh water to spawn. There appears to be no visible difference between them, so a reference genome will help to study the species in more detail.

### **Carrington's Featherwort** (*Plagiochila carringtonii*)

Carrrington's featherwort is a liverwort (an ancient type of plant) only found in areas of high rainfall. In the UK it is found in just a few sites including the mountains of North West Scotland, Ireland, the Faeroes. It is also found in the Himalayas. Interestingly the Scottish plants are all male, and the females are in the Himalayas. These plants developed millions of years before flowering plants. Studying this easily overlooked plant can reveal a whole world of novel genetics.

### **Common Pipistrelle Bat** (*Pipistrellus pipistrellus*)

The common pipistrelle bat is one of the most common bat species in the UK. It weighs the same as a 20 pence piece but can eat 3,000 insects in one night! It was thought to be just one species until 1999 when scientists discovered there were actually two: the common and the soprano. The two bat species can identified by differences in their echolocation frequencies. Studying the genome of the bat will help to reveal more about how and when this split occurred.

### **Summer Truffle** (*Tuber aestivum*)

Fungi are a separate kingdom from animals and plants. When we think of fungi, mushrooms and toadstools come to mind. Truffles are a type of underground mushroom that forms a symbiotic relationship with the root systems of some trees - that is one that benefits both the fungus and the tree by sharing nutrients. The growing interest to harvest truffles for food means that studying the Summer Truffle's genome will reveal more about its reproduction and life cycle.

## Common Starfish (*Asterias rubens*)

If you go to any UK seashore you are likely to see a common starfish in a rock pool. The orange, five armed starfish is more like us than we might think. They produce a hormone linked to puberty that is helping us to understand our evolutionary development. Starfish can also regenerate limbs, so studying their genome could help with medical advances for our species.

## FLOUNDERING

Species that are endangered and declining in the wild.

## Turtle Dove (*Streptopelia turtur*)

Perhaps most familiar from the Twelve Days of Christmas, turtle doves have declined by 93% since 1970, and it is on the Global Red List for Endangered Species. The turtle dove is now only found in eastern England, where farmers are working with the RSPB to create feeding habitats, the destruction of which are blamed for the bird's decline. Understanding its genetics could help with its conservation.

## Water Vole (*Arvicola amphibius*)

The water vole is an iconic species native to the UK but its numbers are in serious decline due to habitat loss and predation by the non-native American mink. There are active conservation and breeding programmes reintroducing voles back into the wild. Sequencing the vole's genome will help with this conservation effort.

## Eurasian Otter (*Lutra lutra*)

The Eurasian otter or common otter is a large semi-aquatic mammal found living by rivers and waterways in the UK. It is a great swimmer and hunts for fish underwater. However, the number of otters has drastically declined in the UK, largely because of polluted water, habitat loss and hunting. Creating a reference genome for this species will help speed up further study to better understand population genetics, the impact of environmental pollutants and the wider effects these may have on the freshwater food chain.

## Northern February Red Stonefly (*Brachyptera putata*)

The Northern February red stonefly is only found in the UK, in North East Scotland and the Highlands. These insects have nymphs (young) that live in the water of rivers and have flying adults. Stoneflies thrive in clean, high quality water. If water quality drops they cannot survive. Due to a number of habitat changes, including acidification and chemical pollution in rivers and streams, the stonefly numbers are declining and they are becoming increasingly rare. Like other at-risk species, studying its genome could help with its conservation.

## Red Squirrel (*Sciurus vulgaris*)

The red squirrel is the only native squirrel species in the UK. This means it is naturally found here. The introduction of the grey squirrel from North America has had a dramatic impact on red squirrel numbers. Today it is only found in Scotland, the far north of England and Northern Ireland. There are also isolated populations in Wales, Merseyside and on small islands off England's southern coast. Sequencing and comparing its genome with the grey squirrel may help to discover new ways to protect the red squirrel against squirrel pox virus, which can be deadly for the red squirrel.

## FLOURISHING

These species numbers are increasing in the wild.

## Grey Squirrel (*Sciurus carolinensis*)

The grey squirrel was introduced to the UK from North America in the 19th century. Its larger size, more flexible diet and better breeding numbers means that it very successfully out-competes the native red squirrel. They can also carry squirrel pox virus, which can be deadly to reds. Sequencing and comparing its genome with the red squirrel may help to understand how it has adapted so well.

## Ringlet Butterfly (*Aphantopus hyperantus*)

This velvety chocolate brown butterfly is unmistakeable when resting on a leaf or flower because of the ring patterns on its wings. Numbers of the ringlet butterfly have increased around 400% in the last 50 years, whereas many other UK butterflies have declined. A reference genome for the species will be a useful tool to compare with other butterflies to understand how it has managed to go against the trend of declining numbers.

## **Oxford Ragwort** (*Senecio squalidus*)

The yellow heads of Oxford ragwort are a familiar sight from train windows. The introduction of the railways in the 19th century helped the plant to spread. It is a hardy plant that seems to be able to grow well in many locations. How has this non-native species become so established? Studying its genome will help scientists to understand how invasive species can succeed in new habitats.

## **Fen Raft Spider** (*Dolomedes plantarius*)

The fen raft spider is the UKs biggest spider, measuring up to 7 cm across! This amazing arachnid lives in fens and other wetlands in Southern England and Wales. The population is under serious threat due to habitat loss. Just three populations are known to exist in Redgrave and Lopham Fen in Suffolk, the Pevensey Levels in East Sussex, and Pant-y-Sais Fen and Crymlyn Bog near Swansea. However, conservation efforts are helping to reverse this poor fortune and numbers are starting to increase. Studying the DNA of this spider species will help with breeding and conservation efforts. This could also reveal more about its semi-aquatic lifestyle, making it a useful bridge between land and water-based spiders.

## **Roesel's Bush-Cricket** (*Metrioptera roeselii*)

The Roesel's bush-cricket is an insect found in the UK. It is brown or yellow in colour and grows up to 26 mm in length. Once restricted to saltmarsh habitats, the chirp of Roesel's bush-cricket can now be heard in many parts of England. Researchers have questioned whether our increased use of salt on our roads is enabling the bush-cricket to spread to new habitats. By studying its genome, researchers may be able to discover genes that enable the bush-cricket to have an increased tolerance to salt.