

SCIENCE - NATURE

Galapagos finches caught in act of becoming new species



A population of finches on the Galapagos has been discovered in the process of becoming a new species. This is the first example of speciation that scientists have been able to observe directly in the field. Researchers followed the entire population of finches on a tiny Galapagos island called Daphne Major, for many years, and so they were able to watch the speciation in progress. The research was published in the journal *Science*. The group of finch species to which the Big Bird population belongs are collectively known as Darwin's finches and helped Charles Darwin to uncover

the process of evolution by natural selection. In 1981, the researchers noticed the arrival of a male of a non-native species, the large cactus finch. Professors Rosemary and Peter Grant noticed that this male proceeded to mate with a female of one of the local species, a medium ground finch, producing fertile young. Almost 40 years later, the progeny of that original mating are still being observed, and number around 30 individuals. "It's an extreme case of something we're coming to realise more generally over the years. Evolution in general can happen very quickly," said Prof Roger Butlin, a speciation expert who wasn't involved in the study. What makes a species? This new finch population is sufficiently different in form and habits to the native birds, as to be marked out as a new species, and individuals from the different populations don't interbreed. Prof Butlin told the BBC that people working on speciation credit the Grant professors with altering our understanding of rapid evolutionary change in the field. In the past, it was thought that two different species must be unable to produce fertile offspring in order to be defined as such. But in more recent years, it has been established that many birds and other animals that we consider to be unique species are in fact able to interbreed with others to produce fertile young. "We tend not to argue about what defines a species anymore, because that doesn't get you anywhere," said Prof Butlin. What he says is more interesting is understanding the role that hybridisation can have in the process of creating new species, which is why this observation of Galapagos finches is so important. The researchers think that the original male must have flown 65 miles from the large cactus finches' home island of Española. That's a very long way for a small finch to fly, and so it would be very unlikely for the bird to make a successful return flight. By identifying one way that new species can arise, and following the entire population, the researchers state this as an example of speciation occurring in a timescale we can observe. In most cases, the offspring of cross-species matings are poorly adapted to their environment. But in this instance, the new finches on Daphne Major are larger than other species on the island, and have taken hold of new and unexploited food. For this reason, the researchers are calling the animals the "Big Bird population". To scientifically test whether the Big Bird population was genetically distinct from the three species of finch native to the island, Peter and Rosemary Grant collaborated with Prof Leif Andersson of Sweden's Uppsala University who analysed the population genetically for the new study. Prof Andersson told BBC News: "The surprise was that we would expect the hybrid would start to breed with one of the other species on the island and be absorbed... we have confirmed that they are a closed breeding group." Due to an inability to recognise the songs of the new males, native females won't pair with this new species. And in this paper, new genetic evidence shows that after two generations, there was complete reproductive isolation from the native birds. As a result, they are now reproductively - and genetically - isolated. So they have been breeding exclusively with each other over the years. "What we are saying is that this group of birds behave as a distinct species. If you didn't know anything about [Daphne Major's] history and a taxonomist arrived on this island they would say there are four species on this island," said Prof Andersson. There is no evidence that they will breed again with the native medium ground finch, but even if they did, they now have a larger size and can exploit new opportunities. Those advantageous traits may be maintained by natural selection. So hybridisation can lead to speciation, simply through the addition of one individual to a population. It may therefore be a way for new traits to evolve quickly. "If you just wait for mutations causing one change at a time, then it would make it more difficult to raise a new species that way. But hybridisation may be more effective than mutation," said Prof Butlin. *BBC*

From the "TRIVIA BOOK"

The Great Lakes are Lake Michigan, Lake Huron, Lake Superior, Lake Erie and Lake Ontario. They are the most important inland waterway in North America. All the lakes, except Lake Michigan, which lies entirely in the United States, are shared by the United States and Canada and form part of the border between these countries. They contain six quadrillion gallons of fresh water, one fifth of the world's fresh water, one fifth of the world's fresh surface water. The Great Lakes have a combined area of 94,230 square miles - larger than the states of New York, New Jersey, Connecticut, Rhode Island, Massachusetts, and Vermont combined.

Sorry!!!
No Tides
for January
We will start
on February

'Please Explain'

No Lead in the Pencil

We have been using lead, a grey or silver or silver-white soft metal, for thousands of years. Although lead has many useful properties, it is, unfortunately, also quite toxic to human beings. As a result, lead has been replaced, in many people still believe the myth conception that lead pencils contain lead. For tens of thousands of years, our ancestors drew on cave walls with pieces of charcoal or sticks. About 3500 years ago, during the 18th Dynasty in Egypt, the technology had advanced from burnt sticks to a thin paint brush around 15-20 cm long. The brush made a fine, wet dark line. About 1500 years later, the Greeks and the Romans realised that sharpened lump of lead would mark papyrus with a dry, light time. Another 1500 years later, during the Middle Ages, European merchants commonly used metal stylus (called a 'metalpoint') which could make faint marks on paper. The merchants made these faint marks like chalk. If the metal were lead- it usually was- it would mark the fingers, so it was often wrapped in paper, string or wood. The beauty of the modern pencil is that it combines the best qualities of the paint brush and the lump of metal in one product. The modern pencil makes a line that is very useful because it is both dry (so that it's easy to see). The modern lead-free lead pencil first appeared in the early 1500s, in Borrowdale, in the Cumberland Lakes District of England. Legend has it that when a large tree blew over, the local shepherds noticed a black material clinging to the roots. They tried to burn it thinking that it was coal- but it would not burn. However, they quickly found a use for it- marking their sheep. The shepherds had discovered graphite, which is actually a variety of carbon. But at the time they thought it was just a variety of lead, so they called it 'black lead'. We know that black lead was not commonly used in pencils up Giovanbattista Palatino, wrote a book describing what he thought would be 'all the tools that a good scribe must have'. It did not include anything that looked like a pencil, or contained graphite. But 25 years later, in 1565, Konrad Gesner, a Swiss naturalist and physician, wrote a book on fossils. In his book, he describes and makes a drawing of a new writing instrument that seems to be the first primitive black-lead pencil. Lead pencils were now becoming common. In 1609, a character in Ben Jonson's play *Epicoene* describes some mathematical instruments including 'his square, his compasses, his brass pens, and black-lead to draw maps'. In 1622, in Nuremberg, Friedrich Staedtler became the first person to mass-produce pencils. In 1683, Sir John Pettus wrote a book on metallurgy in which he noted that the Borrowdale mine produced a type of lead, which was exploited by painters, surgeons and writes. Painters drew their preliminary sketches with it, surgeons used this black lead as a medicine, while writers rejoiced in this new instrument that freed from having to carry a bottle of ink. For a few centuries after its discovery, the Borrowdale black lead remained the highest quality deposit ever found. Besides its medical, painting and writing applications, graphite had very important strategic military functions in casting cannon balls and other metal objects. Therefore, on 26 March 1752, the House of Commons passed a bill entitled, 'An Act for the More Effectual Securing Mines of Black Lead from Theft and Robbery'. This Act made it a felony, punishable by hard labour and/or transportation to the colonies, to steal this high quality graphite. For many years the English would not allow their enemies to use the pure Borrowdale graphite. It was not until 1795, through the urging of Napoleon, that Nicolas -Jacques Conté finally worked out a method of converting low quality graphite into a fine writing material. He ground low quality graphite very finely, mixed it with finely ground clay, fires the mixture at high temperatures, and finished by adding wax before inserting it into slim wooden cases. In 1832, a pencil factory started operations near the Borrowdale graphite supply. In 1916, it became the Cumberland Pencil Factory, which produced the Derwent pencils still love by school children. However, although writing pencils that used lead were still very commonly used in the 18th century. Why? Because they were cheaper, even if they were toxic. You certainly wouldn't want to suck on a 'lead' pencil of it rally had lead in it. In fact, lead pencils became extinct only in the early 20th century. The modern lead pencil is very good technology. It is entirely self-contained, uses no messy liquids such as in, can write a continuous line for some 35km makes a well-defined mark that is relatively smudge-proof and is easy to erase. Today we have glasses made of plastic, tins made of aluminum and golfing irons made of titanium. So it really shouldn't bother us that lead pencils use graphite. **Form of Carbon** It was only in 1779, that the Swedish chemist K.W. Scheele proved that the Borrowdale black lead was not lead, but in fact a form of carbon. It was given a new name, 'graphite' which comes from the Greek verb *graphein*, 'to write'. Graphite is a variety of carbon which is the sixth lightest element, fitting between boron and nitrogen. It is not very common in the Earth's crust (making up 0.025% by weight), but it makes more chemical compounds than any other element. There are three form of pure carbon-when it exists as pure carbon, and is not combined with another element. Diamond, which is the hardest element known, is made up of carbon atoms arranged in a series of tiny pyramids. Another form is called 'buckyballs', where the carbon atoms (typically 60, but there can be more or fewer than 60) are arranged in a hollow ball, like a soccer ball. 'Buck tubes' or 'nanotubes' are very a hollow ball, like a drinking straw. Buckyballs and buckytubes are very strong. In graphite, the carbon atoms are arranged in circles of six that are joined, side by side, to make thin sheets. These thin sheets are stacked on top of each other. The chemical bonds are very strong with each sheet-but are very weak from one sheet to the next. This weak joining makes the sheets easy to slide over each other, making graphite an excellent lubricant. The weak joining also means that when you wipe graphite over a slightly rough surface like paper, a few of the sheets rub off, leaving a mark on the paper. Graphite is also one of the softest known minerals.

Penis to Pencil

The word 'pencil' comes from the Latin word *penicillum*, which was a collection of fine animal tail hairs that had been shoved into a hollow reed. It got its name from *peniculus*, which was the Latin word penis, This meant 'tail' - the location on the animal from which you plucked the hairs.



ENTERTAINMENT

Prince Harry and robot to edit Radio 4's Today Programme Prince Harry and a robot have been announced as two guest editors on Radio 4's Today Programme. Their fellow editors will be Baroness Trumpington, Tamara Rojo and Ben Okri. This is the 14th year control has been handed over to public figures between Christmas and New Year. Kensington Palace said Prince Harry would use the opportunity to "shine a spotlight on issues that are close to his heart". The palace added: "He is working closely with Today's team to produce segments on a range of topics, including youth violence, conservation and mental health." The robot edition of the show will use Artificial Intelligence to conduct an interview through a journalist modelled on current presenter Mishal Husain. That edition of the programme will also ask experts whether AI has become commonplace at work and in the home, and whether it can replicate human characteristics. Other editors are 95-year-old Conservative peer Baroness Trumpington, who was a Land Girl and worked in code-breaking at Bletchley Park during World War Two. The show will also be guest edited by Booker Prize winning Nigerian poet and novelist Benjamin Okri, whose Grenfell Tower poem helped raise funds for victims earlier in the year. Tamara Rojo is the artistic director and lead principal dancer of the English National Ballet and will focus on funding the arts and diversity in ballet. Sarah Sands, editor of Today, said: "We are delighted by the range of guest editors this year. "This Christmas tradition allows our listeners to benefit from the experiences and perspectives of remarkable public figures. "We finish with a programme dedicated to AI which gives a glimpse of the future of Today." The exact dates of the special Today editions have not yet been confirmed. *BBC*