How vampire bats survive on a diet of blood

April 18 2018, by Kirsten Flint

It may seem batty, but blood is the diet of choice for several species of bats. Now, scientists discover that jumping genes provide the evolutionary key to this vampiric life.

Blood is a pretty risky meal and doesn't carry that much nutritional reward.

Every time a bat drinks blood, it is exposed to a whole host of diseases including rabies, Ebola and HIV.

Once it gets past the life-threatening disease, there's all the protein to deal with. Blood is jam-packed with the stuff, and processing that much protein can place a huge amount of pressure on the kidneys.

Blood is also exceptionally low in almost all nutrients, vitamins and minerals—apart from iron, which it has lots of.

In spite of this, vampire bats drink the red stuff on a regular basis.

So when other bats are munching on fruits, flowers and flies, what's made these suckers choose the gothic option? And how has it not killed them?

A recent genetic analysis has provided us with new clues.

JUMPING GENES

DNA analysis suggests that it's been a joint evolutionary effort between the bat's genes as well as the bugs that live in their guts.

International researchers (including geneticists from Curtin University) analysed the genome of the common vampire bat and the DNA present in its microbiome (collected via faecal samples). Together, these two sets of DNA are called the hologenome—the entire set of living genes in the organism.

The vampire bat's hologenome was then compared with those of bats that ate insects, fruit, nectar or meat. The differences the researchers found suggest that both the bloodsucking bat and its gut bugs have undergone evolutionary change to enable their vampiric habit.

Although the bat genome was similar in size to that of the other bats, it contained more jumping genes.

These are sections of the genome that are able to copy and paste themselves at multiple positions throughout the DNA. Scientists call them transposons.

One particular type of transposon was 2.2 times more present throughout the common vampire bat's genome than in that of its fruitier cousins. These jumping chunks of genetic code mostly turned up in vampire bat DNA sequences that coded for immunity, viral defence and lipid and vitamin metabolism.

The researchers suggested that, by having more transposons present, the bat's DNA would be disrupted more often, allowing it to adapt to its bloody diet. It would be better able to process the large amount of blood required to sustain it without succumbing to illness.

IT TAKES GUTS

But it wasn't only the vampire bat's genome that appeared to evolve. Its gut microbiome presented entirely differently to that of nectar-feeding, fruit-eating and meat-eating bats, and researchers suggest a unique collection of gut bacteria helps the bloodsuckers get the most out of their meals.

There were more than 280 species of bacteria present in the faeces of the vampire bats that would have made other mammals very ill. However, many of these 280 species are known to be transmitted by bloodsucking insects such as ticks and mosquitoes. Could they be a necessary feature of all blood-based diets?

There were other signs that bacteria within the digestive system prevented the bat's bloody meal from clotting on its journey through the bat's gut.

Certain varieties of bacteria with antiviral properties were found in large proportions in the vampire bat guts.

These digestion-assisting and immunity-protecting bacteria would likely have been incorporated into the microbiome alongside changes to the bat's genome.

YOU ARE WHAT YOU EAT

Scientists suggest that vampire bats made the shift towards bloodsucking behaviour millions of years ago.

Perhaps by shifting from eating all insects to eating only bloodsucking parasites, they were able to specialise and make their feeding technique highly efficient.

Then, by cutting out the insect middleman and consuming solely blood, they reduced all competition from other animals who would otherwise be eating their meals. They created a niche in which they could thrive … as long as they could survive the bloodborne diseases.

Thus, those bats whose genes mutated were able to adapt faster, and that's where having lots of transposons might have come in handy for the vampire bat.

Coincidentally, about half of the human genome is made of transposons. So why haven't we evolved the ability to drink the nutritionally and ethically dubious substance?

Whilst human history is scattered with cases of vampirism, our evolutionary circumstances haven't necessitated quite the genetic changes that come with a blood-only diet.

We're not certain of the environmental pressures that our ancestors experienced, but it seems that evolving the pointed canines and blunted molars of an omnivore seemed to help mankind survive. This allows us to eat a bit of everything, apart from blood. We'll leave that one to the bats.

This article first appeared on Particle, a science news website based at Scitech, Perth, Australia. Read the original article.

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