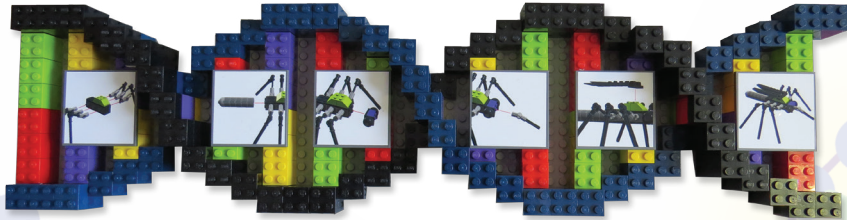




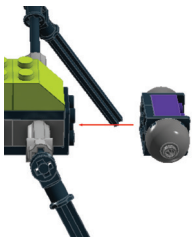
How about you give gene editing a try?  
Follow the DNA instructions to build a mosquito  
and then use our CRISPR tool to edit a selected  
gene and stop it spreading disease.



Now that you have a mosquito, how  
would you change it to stop it from  
biting humans? There are four options...



1.



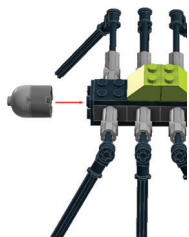
Change its  
eye colour

2.



Make its  
wings small

3.



Shorten  
its tail

4.



Remove its  
mouth piece



# BUG BUSTERS

## Bugs and beasties spread diseases



### Using gene editing to bust those bugs

Like all living things, the cells in our body  
use a set of instructions called DNA which  
tell us how to grow and how to work.  
Similar to the way Lego® instructions show  
you how to build a working Lego® model  
from all the pieces.

In insects, DNA can determine everything  
from how big they are, to whether they want  
to bite humans or other animals, and even if  
they can spread disease.



But what if we could change these DNA instructions?



## Bugs that need busting

Mozzies, midges and ticks spread loads of nasty diseases across the world to both animals and people. In fact, some of these beastly bugs spread diseases that can be transmitted from animals to people – these are called zoonotics.

It's the female insects you need to watch out for though! Those irritating bites you receive on holiday are a result of the female mosquito's thirst for blood. This vampire like trait helps her to get the nutrients she needs to produce her eggs, but can also result in her carrying diseases in the blood of one animal on to the next.



## Diseases that need combatting

Deadly diseases like malaria, dengue, yellow fever, ebola, chikungunya, West Nile virus, Rift Valley fever, bluetongue, African horse sickness and Crimean Congo haemorrhagic fever have a devastating effect across the world and scientists are trying hard to discover ways to combat these.



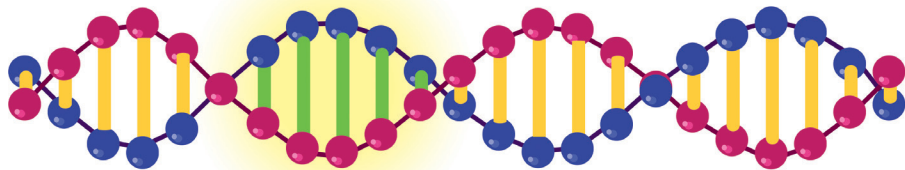
## How genes get cut and pasted

Gene editing enables scientists to change genes – sections of an organism's DNA. This is a bit like changing a set of Lego® instructions. By altering the instructions, the model that you eventually build will be slightly different.

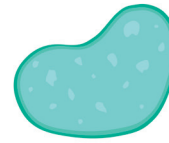
Recently, an exciting new technology called CRISPR/Cas9 has made it much easier for scientists to edit DNA. Two parts work together to find the right gene

that needs to be edited and then cut the DNA in an exact location.

This enables scientists to snip out genes that aren't needed, or even insert or 'paste' in completely new genes. The method can be used to mend mistakes that cause disease, to prevent a set of instructions from being carried out, or even give an insect new characteristics or abilities.

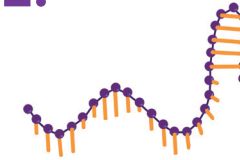


1.



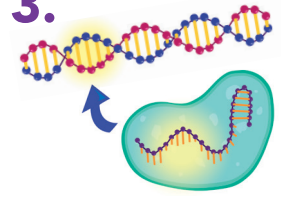
Cas9 is an enzyme that acts like 'molecular scissors' to cut DNA.

2.



Scientists create a genetic sequence called a 'guide RNA' that pairs with the piece of DNA they want to delete, insert or change.

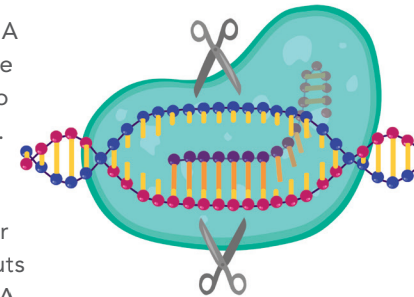
3.



The guide RNA sticks to Cas9 in the cell and together they seek out the target DNA sequence.

4.

Cas9 unzips the target DNA and allows the guide RNA to find a match. Then Cas9 goes in with the molecular scissors and cuts the target DNA.



5.



Once cut enzymes in the cell repair the DNA, disabling or altering the gene.



## How our scientists bust bugs using CRISPR

Pirbright scientists are using CRISPR to help control populations of disease-spreading mosquitoes. Researchers edit the DNA of mosquitoes to prevent them from producing fertile offspring. They are then released into the wild in specific areas, which lowers the population enough to stop the mosquitoes from spreading disease.

Using gene editing to control insect populations is a preferable control technique as it is able to target a specific species, unlike pesticides which can affect entire food chains.