# Why are worms used for research?

## Which worm?

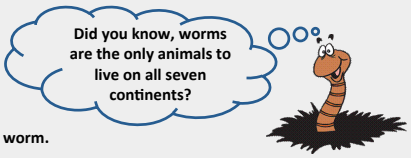
- There are over one million different types of worms worldwide. But scientists use one particular type of worm for research.
- In the 1960's the Medical Research Council (MRC) decided to look for an animal to easily study the genetic control of behaviour. Scientists chose to use microscopic *C. elegans* worms. This worm was found in a rubbish heap in Bristol in south west England, UK.

**Bristol, England, UK.**

- Since there are so many different kinds of worms why did researchers decide to use the small little worms found in Bristol?
- Why not use Dave the worlds largest earthworm found in the UK, measuring a huge 40 cm!
- Lots of Dave-sized worms would take up too much space in a laboratory. *C. elegans* worms are perfect for laboratory research as they are very small so scientists can keep millions of these wriggly worms. They are also easy to look after and cheap to maintain.


**Dave, the UK's largest earthworm.**

- *C. elegans* worms are now used by scientists worldwide. Who would have thought that a tiny worm from Bristol would now be used by thousands of research scientists.
- Read our "Top 10 *C. elegans* facts" to find out more.



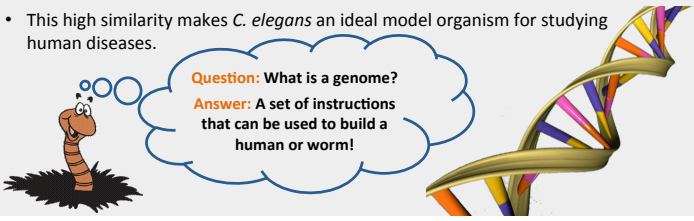


**A *C. elegans* worm.**

## How similar are worms and people?

At first you wouldn't think there are any similarities between worms and people. Worms are tiny in comparison to humans. Even though worms are small they do share a number of common features with humans, for example:

- Worms have muscles, a gut, nerves and also a circulatory system. These are all body systems that humans also have.
- Just like humans, worms convert food into energy and carryout out purposeful movement. When humans are hungry they will walk to the shops to buy food. Worms are unable to go to the shops, but when worms smell food they wriggle towards it.
- Whole genome sequencing revealed that *C. elegans* has ~19,000 genes whilst humans have ~25,000 genes.
- Up to 80% of the genes in *C. elegans* are similar to human genes.
- This high similarity makes *C. elegans* an ideal model organism for studying human diseases.




## What diseases are studied in worms?

*C. elegans* are used to help scientists understand common problems, for example:

- Ageing
- Cancer
- Diabetes
- Neurodegeneration (e.g. Alzheimer's disease).

Rarer disease are also studied in the worm such as muscular dystrophy, paediatric mitochondrial disease, polycystic kidney disease and Wilson disease.

## Top 10 *C. elegans* facts

**1.** *C. elegans* are small, transparent multicellular organisms.

**2.** They live in microbe-rich environments such as soil.

**3.** *C. elegans* eat bacteria such as *Escherichia coli* (*E. coli*).

**4.** They have two sexes, males and self-fertilising hermaphrodites.

**5.** Adult *C. elegans* are approximately 1mm in length.

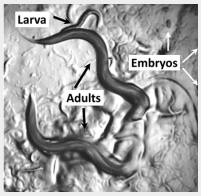
**6.** One petri dish may contain 10,000 *C. elegans*.

**7.** One hermaphrodite can produce 300-350 offspring.

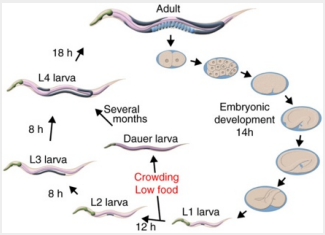
**8.** C. *elegans* have short life cycles. It takes 3 days for an egg to reach adulthood.

**9.** They live for between 2 to 3 weeks.

**10.** Under stressful conditions *C. elegans* go in to a 'dauer stage' (dormant phase) and are capable of living much longer than their normal lifespan.



**Visualisation of *C. elegans* life cycle stages**



**The life cycle of *C. elegans*.**

## How has studying worms changed medicine?

Research using *C. elegans* has led to some huge scientific discoveries.

- Lazy worm researchers wanted to understand the genetic basis of behaviour. However, they found it difficult to identity individual genes so instead they decided to take an easier option and sequence the entire genome. Five years after the *C. elegans* genome was sequenced scientists were able to sequence the whole human genome.
- Whole genome sequencing has created a new type of medicine called 'personalised medicine'. Personalised medicine is an approach whereby patients have their genomes sequenced to individually tailor diagnosis and treatment of disease.
- Another worm researcher decided that he wanted to know how worms reproductive organs are made. Whilst trying to work this out he stumbled upon a process called 'programmed cell death'. This is a fundamental process in humans as well as worms. If we didn't have this process the skin between our fingers would fuse together and we would have webbed hands. The process of programmed cell death gives us hands with independent fingers.

- Programmed cell death is an important process in many disease such as Alzheimer's disease and cancer. In cancer this process goes wrong and it causes cells to multiply causing tumours.
- More clever scientist wanted to figure out what controls muscle gene expression in worms. They ended up discovering a pathway that switches off gene expression called RNA interference or RNAi. RNAi is being tested as a therapy for a range of diseases such as cancer and liver disease.


## For more information:

1. Worm Book http://www.wormbook.org/
2. Nobel Prize http://www.nobelprize.org/
3. Worm Atlas http://www.wormatlas.org/
4. Dave the earthworm http://www.bbc.co.uk/newsround/37869941

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