

Amazing DNA facts



These facts can form the basis of a quiz (eg. how many base pairs are there in the human genome?). Students should be familiar with most of this material, so the quiz could be run at any point in the day.

Probably best doing this as a quick-fire quiz - maybe put the students into teams and give some kind of reward to the winners (e.g. loading their gels first).

- DNA is found inside every cell in our body (red blood cells don't have nuclear DNA, but they do have mitochondrial DNA).
- Each cell contains roughly 2 metres of DNA.
- Humans have roughly 100,000,000,000,000 (100 trillion cells).
- If you unravelled all your DNA from all of your cells and laid out the DNA end to end, the strand would stretch from the Earth to the Sun hundreds of times (the sun is approximately 98 million miles away from Earth).
- You could fit 25,000 strands of DNA side by side in the width of a single adult hair.

- The DNA is tightly coiled up and structured into 46 chromosomes.
- Our chromosomes are arranged in pairs. We inherit one copy of the pair from our Mum and one from our Dad.
- When chromosomes are stained they can be quite easily recognised by their distinctive stripy patterns. This is used to check whether people have the right number of chromosomes and check for any rearrangements.

- There are approximately 3 billion (3,000,000,000) chemical letters (otherwise known as bases) in the DNA code in every cell in your body.
- This is a massive amount of information. It would fill 200 yellow pages in small type font.
- If you tried typing the whole genetic code out (typing at 200 letters per minute) it would take 29 years (without taking any breaks!).

- The DNA is made up of 4 building blocks (an alphabet of 4 letters spelling out the instructions to help us grow, develop and function).
- The four letters in the DNA alphabet - A, C, G and T - are used to carry the instructions for making all organisms. The sequence of these letters holds the code - just like the order of letters that makes words mean something. Each set of three letters corresponds to a single amino acid.
- Sections of DNA which code for proteins are called genes. The complete set of genetic information for an organism is called the genome. The latest estimate is that there are between 20,000 and 25,000 genes in the human genome.
- We share a lot of DNA with other animals, plants and microorganisms. The table below shows some figures on shared sequence between species (please note that these figures are regularly revised, as more DNA sequencing is completed).

Species	How many genes do we share with them?
Chimpanzee	98%
Mouse	92%
Zebrafish	76%
Fruit fly	51%
Weed (thale cress)	26%
Bacteria (E coli)	18%

Questions on evolution



This could just be a stand-alone 5 minute activity. Probably best to write some of the statements onto a whiteboard and give the group time to think about the answers. You could go through the answers as a group, or go through them with the students as they are waiting to load their gels.

1. Try to rate the following in order of how similar you think their DNA is to your own:
 - The person sitting next to you
 - A chicken
 - A banana
 - A mouse
 - A chimpanzee
2. Approximately what percentage of each their DNA do you think is the same as your own?
3. Humans have twice as many DNA bases in each cell than a mouse. True or false?
4. Humans are more evolved than chimps. True or false?
5. How many known different species are there on Earth?
6. What is the estimated number of species we don't yet know about? (could give options)

Answers & notes

- 1 & 2: Person sitting next to you – 99.9%
 Chimpanzee – 98%
 Mouse ~ 75%
 Chicken ~60%
 Banana ~ 50%

Be sure to point out that the differences between these are low in terms of percentage, but that subtle differences in the sequences of each gene can lead to a functional difference in the protein it codes for. It is also important to point out that, because the full genomes of most species have not been fully mapped, these are estimates based on the genes that have been studied to date.

3. False – we have 3.2 billion, mice have 2.6 billion.
4. False – make sure students understand that different species evolve different characteristics over time, as opposed to humans being 'most evolved'.
5. About 1.8 million species have been given scientific names (over 1 million are insects).
6. Estimates of the total number of living species range from 10 to 100 million. It is likely the actual number is on the order of 13 to 14 million (most being insects & microscopic life forms). However, we may never know because many of them will become extinct before being counted and described.

Practicing with pipettes



Three options to try to get students more skilled...

Closest count

Before the workshop, measure out exactly 1024 μl into 5 tubes (one per bench). Everyone on the bench has to take it in turns to remove some liquid and as a group, they keep a running total of the volume removed from their tube.

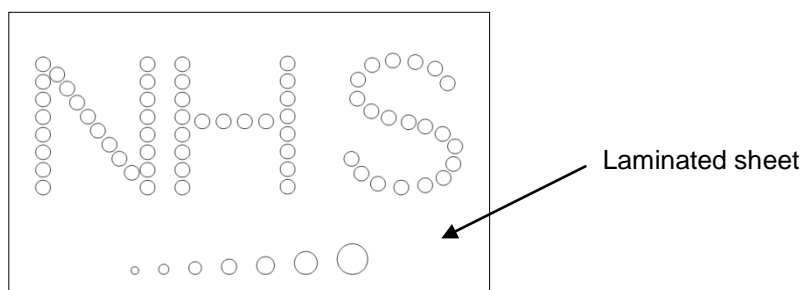
The groups continue to remove liquid from their tubes until the tubes are empty. Ask the benches to make the most accurate estimate of the total content in the tube.

This is quite tough, so if the group get it within the range of 1015 - 1030 μl – it's close enough.

Filling the circles

We have printed and laminated some sheets with printed circles on them (of different sizes). We will give students different colours of food dye to have to go at filling the circles as neatly as they can to fill the dots (and see how many microlitres of liquid it takes to fill the circle).

We're not convinced this will really help them develop their skills greatly, as students might use the pipettes to simply drag liquid about, but it will hopefully keep them practicing for a bit longer.



Weighing game

The students are challenged to measure out exactly 50 μl and 150 μl of water onto the balance (50 μl should weight 50 μg). This relies on being able to use accurate scales.

Use a weighing tray and zero the balance and invite individuals up.

With only one balance in the lab - you could organise this one bench at a time. Students will probably need help with the balance.

This is also dependant on the sensitivity of the balance and accuracy of pipettes (depending on whether they have been calibrated recently).