



TEACHER'S NOTES

SPELLING
MISTAKES
IN DNA

OVERVIEW

Aimed at **key stage 4** pupils.

In this activity, the class will learn how changes in the dystrophin gene can lead to Duchenne Muscular Dystrophy (DMD).

CURRICULUM LINKS

- ★ **KS4:** The ways in which organisms function are related to the genes in their cells
- ★ **KS4:** Human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments

LEARNING OBJECTIVES

- ★ DNA codes for proteins
- ★ Changes in the DNA sequence may lead to a shortened protein, which can have very serious implications (such as causing Duchenne Muscular Dystrophy)

PREPARATION Activity

- ★ Print worksheet
- ★ Watch **Connor's film** on Genes Are us website
- ★ Class complete worksheet
- ★ This activity could be run in conjunction with **Twisting the DNA ladder** activity

ANSWERS

Person 1: TATGGCCAGCTTATTTTTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

Person 2: TATGGCCAGCT**TAA**TTTTTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

Person 3: TATGGCCAGCTACTTATTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

Person 4: TATGGCCAGCT**TAG**TTTTTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

Person 5: TACGGCCAGCTACTTTTTGTACTTTTACAGACAGGGTTTCATATTGGCTCA

Person 6: TATGGCCAGCTACTTATTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

Person 7: TATGGCCAGCTTGTTTTTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

Person 8: **TAG**GGCCAGCTTATTTTTGTACTTTTACAGACAGGGTTTCATATTGGCTCA

1. Which of the 8 people carry a stop code?

The sequences for person 2, 4 and 8 all contain a STOP code.

2. Can you explain in your own words why these individuals may have DMD?

If someone had a stop code in the middle of their dystrophin gene, it would prevent their body reading the full gene and stop the body making the protein. If this was the only copy of the gene they had, they would be very likely to get DMD.

3. How do you think computers might be used to process DNA sequences?

Computers can accurately and quickly process lots of data, so could be very efficient in searching for particular sequences, such as stop codes.

FURTHER information

See Genes Are Us Teacher Factsheet on DMD for basic information. For more detailed information, link to the patient support group: Muscular Dystrophy Campaign:
www.muscular-dystrophy.org

Dystrophin is a protein that connects the cytoskeleton of a muscle cell to the extracellular matrix (i.e. connects the muscle cell to its surroundings).

Dystrophin is one of the largest known genes, covering 2.4 megabases (ie. 2.4 million letters of the DNA code, which makes up 0.08% of the human genome).

It is located on the X chromosome. DMD is often caused by mutations which result in a truncated protein, caused by a STOP codon - generated by a mutation.

Cells without this protein experience increased oxidative stress and eventually die, resulting in muscle wastage.

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SPELLING MISTAKES IN DNA

The information held in your DNA is used by your body to produce proteins. Your body can read the letters in the DNA sequence to understand what proteins to make. The dystrophin gene codes for a protein that helps muscle to work.

Duchenne Muscular Dystrophy (DMD) occurs when someone does not have a working copy of the dystrophin gene. A faulty copy of the gene (which has a mutation) can stop the protein being made at all.

You can think of a mutation being like a spelling mistake in the DNA. One type of spelling mistake stops the gene being read in full. This usually stops the protein being made at all and this can have serious implications. Some people who have DMD have this type of spelling mistake in their DNA.

If a new spelling mistake generates a '**stop code**' in the middle of a gene, it can cause medical conditions, such as Duchenne Muscular Dystrophy. This box tells you what DNA stop codes are:

DNA 'stop codes' =
TAG, TAA or TGA.

The following DNA sequences are from eight different people (some have DMD and others do not). Can you find any 'stop codes' in the DNA below?

PERSON 1 TATGGCCAGCTTATTTTTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

PERSON 2 TATGGCCAGCTAATTTTTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

PERSON 3 TATGGCCAGCTACTTATTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

PERSON 4 TATGGCCAGCTAGTTTTTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

PERSON 5 TACGGCCAGCTACTTTTTGTACTTTTACAGACAGGGTTTCATATTGGCTCA

PERSON 6 TATGGCCAGCTACTTATTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

PERSON 7 TATGGCCAGCTTGTTTTTGTATTTTACAGACAGGGTTTCATGTTGGCTCA

PERSON 8 TAGGGCCAGCTAATTTTTGTACTTTTACAGACAGGGTTTCATATTGGCTCA

- 1 Which of the 8 people carry a stop code?
- 2 Can you explain in your own words why these individuals may have DMD?
- 3 How do you think computers might be used to process DNA sequences?

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