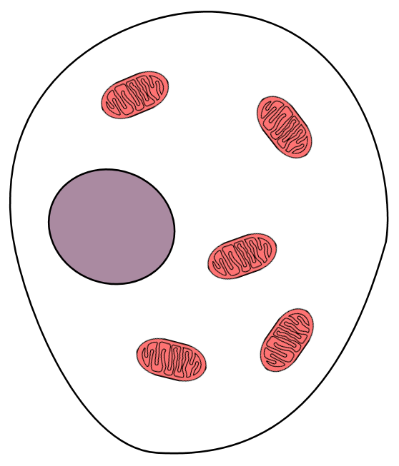
**DNA, chromosomes, genes and genomes**



cell membrane

nucleus

cytoplasm

The diagram shows a human cheek cell.

Choose the right answer to complete each sentence about the cell, or choose “I’m not sure” if you can’t decide.

1. The cell contains 46…

|  |  |
| --- | --- |
| **A** | chromosomes. |
| **B** | genes. |
| **C** | genomes. |
| **D** | I’m not sure |

1. A chromosome is made of…

|  |  |
| --- | --- |
| **A** | DNA. |
| **B** | genes. |
| **C** | genomes. |
| **D** | I’m not sure |

1. Some regions of a DNA molecule are called…

|  |  |
| --- | --- |
| **A** | chromosomes. |
| **B** | genes. |
| **C** | genomes. |
| **D** | I’m not sure |

1. All the chromosomes together make up the cell’s…

|  |  |
| --- | --- |
| **A** | genes. |
| **B** | genome. |
| **C** | I’m not sure |

*Biology> Big idea BHL: Heredity and life cycles > Topic BHL1: Inheritance and the genome > Key concept BHL1.2: The structure and function of the genome*

|  |
| --- |
| **Diagnostic question** |
| **DNA, chromosomes, genes and genomes** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The structure and function of organisms depends on proteins made by cells using instructions stored in the DNA of the genome. |
| Observable learning outcome: | Distinguish between the terms DNA, chromosome, gene and genome. |
| Question type: | Simple multiple choice |
| Key words: | DNA, chromosome, gene, genome |

**What does the research say?**

Numerous researchers have reported that students mix up the terms ‘gene’, ‘chromosome’ and ‘DNA’, perhaps thinking that they are synonyms, and struggle to understand the relationship between them (e.g. Lewis and Kattmann, 2004; Donovan and Venville, 2012). Lewis, Leach and Wood-Robinson (2000) reported that students aged 14-16 performed poorly when asked to rank them in order of size.

Science education researchers have acknowledged that teaching and learning about inheritance and genetics at school must aim to prepare students to live and work in the genomic era, in which the genomes of many organisms have been sequenced and the study of whole genomes (rather than just genes) generates numerous applications and implications for our everyday lives (Stern and Kampourakis, 2017). Up to the age of 14, a useful approach may be to embed ‘pro-genomics’ and ‘pre-genomics’ practices – for example, use of language and concepts that dispose students to thinking about whole genomes rather than just genes, and ensuring that students understand the difference between DNA, chromosomes, genes and the genome (Airey, Moore and Bennett, 2018).

**Ways to use this question**

Students should complete the question individually. This could be a pencil and paper exercise, or you could use the PowerPoint presentation with an electronic voting system or mini white boards.

*Differentiation*

You may choose to read the speech bubbles and the question to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

1. A – chromosomes
2. A – DNA
3. B – genes
4. B – genome

**How to respond - what next?**

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs. Responses often work best when the activities involve paired or small group discussions, which encourage social construction of new ideas through dialogue.

Researchers have used constructivist approaches that enable students to build their own explanations of the structure and function of the genome, which may help to develop students’ understanding and overcome misconceptions, including the use of group discussions (e.g. Lewis and Kattmann, 2004). If students have misunderstandings about the hierarchical relationship between DNA, genes, chromosomes and genomes, the following BEST ‘response activities’ describe small group discussion tasks that could be used in follow-up to this diagnostic question:

* Response activity: How does it all fit together?
* Response activity: Genome numbers game

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Developed by Alistair Moore (UYSEG).

Images: mitochondria – Wikimedia Commons/Nevit (adapted by UYSEG); all other drawings – UYSEG

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