**Locating the genome**

**Part 1**

Do you think the things in the pictures have a genome?

(The pictures are not to the same scale.)

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
| a human | a cat | a plant |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| a car | a dead tree | bacteria |

Which statement do you agree with for **each** picture?

|  |  |
| --- | --- |
| **A** | It has a genome. |
| **B** | It does **not** have a genome because it is not a living organism. |
| **C** | It does **not** have a genome because it is not made of cells. |
| **D** | It does **not** have a genome because it is not human. |

**Locating the genome**

**Part 2**



Where in the human body are copies of the genome stored?

|  |  |
| --- | --- |
| **A** | Only in cells in the blood. |
| **B** | In many different types of cells throughout the body. |
| **C** | In cells on the outside of the body, such as skin and hair. |
| **D** | Only in cells of the reproductive system. |

**Locating the genome**

**Part 3**



Where in a plant are copies of the genome stored?

|  |  |
| --- | --- |
| **A** | Only in cells that make up reproductive structures, such as flowers and seeds. |
| **B** | In cells on the outside of the plant, such as leaves. |
| **C** | In many different types of cells throughout the plant. |
| **D** | Only in cells of the roots and stem. |

*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** |
| **Locating the genome** |

**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: | Recall that all organisms store heritable genetic information in their genome inside cells. |
| Question type: | Simple multiple choice |
| Key words: | genome |

**What does the research say?**

Various researchers (e.g. Lewis, Leach and Wood-Robinson, 2000; Wood-Robinson, Lewis and Leach, 2000; Lewis and Kattmann, 2004; Donovan and Venville, 2012; Witzig et al., 2013) have reported common misunderstandings about DNA, genes and chromosomes in school children, including that:

* some non-living things (e.g. cars) have DNA, and some living organisms (e.g. plants and bacteria) do not;
* DNA is only found in blood;
* DNA is only found in specific cell types (e.g. in the reproductive system);
* uncertainty over whether dead organisms contain DNA;
* DNA exists only to help solve crimes, and is therefore only found in skin and hair that can be shed at crime scenes.

Teaching and learning about inheritance and genetics at school must aim to prepare students to live and work in the genomic era (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 (Airey, Moore and Bennett, 2018).

**Ways to use this question**

Students should complete the questions 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 questions 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**

*Part 1*

Human, cat, plant, dead tree, bacteria – A – It has a genome.

Car – C – It does not have a genome because it is not made of cells.

*Part 2*

B – In many different types of cells throughout the body.

*Part 3*

C – In many different types of cells throughout the plant.

**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 drawing and group discussions (e.g. Lewis and Kattmann, 2004; Rotbain, Marbach-Ad and Stavy, 2005; Saka et al., 2006). If students have misunderstandings about which types of human body cells store a copy of the genome, the following BEST ‘response activity’ provides a drawing and discussion-based activity that could be used in follow-up to this diagnostic question:

* Response activity: Drawing the genome in body cells

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plant in pot – UYSEG; car – pixabay.com/chapay (2683858); dead tree – pixabay.com/SilviaP\_Design (1606489); bacteria – cellimagelibrary.org/James D. Jamieson (37254); girl – pixabay.com/PublicDomainPictures (315072); iris plant – pixabay.com/ArtsyBee (1241708)

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