**DNA**



The table contains statements about DNA.

Some of the statements are **right** and some are **wrong**.

Tick **one** box for each statement.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statements** | | I am **sure** this is right | I **think** this is right | I **think** this is wrong | I am **sure** this is wrong |
| **1** | The genome is made of DNA. |  |  |  |  |
| **2** | DNA is alive. |  |  |  |  |
| **3** | DNA is made of genetic information. |  |  |  |  |
| **4** | All organisms contain DNA. |  |  |  |  |
| **5** | DNA is made of cells. |  |  |  |  |
| **6** | The shape of DNA is called a triple helix. |  |  |  |  |

*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** |

**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: | Recognise that the genome is made of a chemical substance called DNA. |
| Question type: | Confidence grid |
| Key words: | genome, DNA |

**What does the research say?**

Children can struggle to explain inheritance because of the need to link together understanding at various interacting levels, including the visible trait/phenotype level (e.g. hair colour), the metaphorical information level (e.g. the ‘genetic information’ that can affect hair colour), and the microscopic/molecular structural level (e.g. the genome, made of DNA, in which the genetic information is encoded) (Lewis and Kattmann, 2004; Duncan and Reiser, 2007).

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

* DNA is alive;
* DNA is made of cells;
* DNA is only found in blood, or only in specific cell types (e.g. in the reproductive system);
* some living organisms (e.g. plants and bacteria) do not have DNA;
* genes and DNA are different entities, and specifically that genes are responsible for family resemblance while DNA makes you unique and identifiable (e.g. if it is discovered at a crime scene);
* the terms ‘DNA’ and ‘genetic information’ have the same meaning (inability to distinguish the chemical structure from the information it encodes).

**Ways to use this question**

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

*Differentiation*

You may choose to read the statements 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. The genome is made of DNA – **right**
2. DNA is alive – **wrong** (DNA is a chemical substance, is not made of cells, and does not carry out all of the characteristic processes of living organisms)
3. DNA is made of genetic information – **wrong** (DNA *stores* genetic information, but is a chemical substance made of many molecules joined together)
4. All organisms contain DNA – **right**
5. DNA is made of cells – **wrong** (DNA is a chemical substance made of many molecules joined together, and is stored inside cells)
6. The shape of DNA is called a triple helix – **wrong** (it’s called a double helix)

**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 DNA and the genome, which may help to develop students’ understanding and overcome misconceptions, including challenging student to make models of DNA using sweets, pipe cleaners, paper, or other suitable materials (e.g. Sindall, 2003; Altiparmak and Nakiboglu Tezer, 2009).

If students have misunderstandings whether DNA is a physical substance stored inside cells, numerous protocols are available online for the extraction of DNA from material such as onions, split peas, fish eggs and fish sperm (milt). Note that fruits such as kiwi fruit, strawberry and pineapple are often used, but it has been reported that the white strands extracted from these sources may be mostly pectin rather than DNA (Madden, 2015).

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Images: pixabay.com/PublicDomainPictures (163710)

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