**Inheriting the genome**

The diagrams show cells from a human mother, a human father and their baby.

**To discuss**

The diagrams do not show the genome of each cell.

* What do you think the genomes would look like?
* What would you draw to add the genomes to the cell diagrams?

**To do**

Complete the diagrams by drawing the genome inside each cell.

|  |  |
| --- | --- |
| cytoplasm  nucleus  cell membrane |  |
| Cell from mother | Cell from father |
|  | |
|  | |
| Cell from their baby | |

*Biology> Big idea BHL: Heredity and life cycles > Topic BHL1: Inheritance and the genome > Key concept BHL1.1: Heredity and genetic information*

|  |
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| **Response activity** |
| **Inheriting the genome** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Similarities and differences between family members can be explained by the passing of genetic information from one generation to the next and the effects of the interaction of organisms with their environment. |
| Observable learning outcome: | Explain that biological characteristics are inherited when genetic information stored in the genome of each parent is passed to offspring. |
| Activity type: | Discussion, modelling |
| Key words: | heredity, reproduction, genome |

This activity can help develop students’ understanding of the idea that biological characteristics are inherited because offspring (from sexual reproduction) inherit half of their genome from each parent. It can be used in response to the following diagnostic question:

* Diagnostic question: Baby’s eyes

**What does the research say?**

Studies have found that 11 and 12-year-old students can struggle to link “characteristics that you get from your parents” to inherited genetic information (Cisterna, Williams and Merritt, 2013).

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. eye colour), the metaphorical information level (e.g. the ‘genetic information’ that affects eye colour), and the microscopic/molecular structural level (e.g. regions of the genome in which information that affects eye colour is encoded) (Lewis and Kattmann, 2004; Duncan and Reiser, 2007).

Several studies have suggested introducing explanations of heredity to children using, initially, a very simplified idea of genetic material to serve as a ‘conceptual placeholder’ or ‘conceptual peg’. This can help children to “hold in place” a rudimentary scientific explanation upon which more detailed explanations of what is inherited and how can be built later (Solomon and Johnson, 2000; Ergazaki et al., 2015). The concept of “the genome” can usefully be used as such a conceptual placeholder, and is a pro-genomic idea (unlike the more restrictive “genes”) that will help prepare children to learn about the structure and function of the genome later (Airey, Moore and Bennett, 2018).

Researchers have used formative assessments coupled with constructivist approaches that enable students to build their own explanations of heredity, which may help to develop students’ understanding and overcome misconceptions, including the use of drawing and group discussions (e.g. Lewis and Kattmann, 2004; Chin and Teou, 2010).

**Ways to use this activity**

Students should complete this activity in pairs or small groups. The focus of the activity should be on group discussion to reach a consensus on what the drawings of the genomes should look like. It is through the discussions that students can check their understanding and develop their explanations. Listening in to the conversations of each group will often give you insights into how your students are thinking.

Alternatively, students could be asked, individually, to draw the genome in the nucleus of each cell. In groups, the students’ diagrams could be ‘peer assessed’, with an emphasis on small group discussion to provide constructive feedback rather than simply criticising or assigning a score.

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in the each group. For example, you may choose to select a student with strong prior knowledge as a scribe, and forbid them from contributing any of their own answers. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

After their discussions, each group should be prepared to report the key points of their discussion to another group, or to the class.

*Differentiation*

Some students could be provided with the worksheet upon which arrows have been drawn from the two parent cells to the baby cell, to provide a prompt.

**Equipment**

For each pair/group:

* coloured pencils/pens/crayons
* paper (if not drawing on the worksheet)

**Expected answers**

The genome should be drawn inside the nucleus of each cell. Students may draw the genome using representations of DNA, chromosomes, or just squiggles. They may use different colours, or some other indication, to show that they genomes of the parents are not identical. The genome of the baby should indicate that roughly half has been inherited from each parent, e.g. by drawing half of it in each of the colours used for the parent genomes, or by using a colour that would result from mixing the two parent colours together (e.g. purple, if the parents’ genomes are red and blue).

**Acknowledgments**

Developed by Alistair Moore (UYSEG), from an idea suggested by Lewis and Kattmann (2004).

Images: UYSEG

**References**

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