**Exercise**



Why does our heart rate increase when we exercise?

Tick **one** box for each answer.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Answers** | | I am **sure** this is right | I **think** this is right | I **think** this is wrong | I am **sure** this is wrong |
| **1** | So that the heart can pump more air to the muscles. |  |  |  |  |
| **2** | So that more carbon dioxide can be transported from the lungs to the muscles. |  |  |  |  |
| **3** | So that more oxygen can be transported from the lungs to the muscles. |  |  |  |  |
| **4** | Because there is a faster rate of cellular respiration in the muscles. |  |  |  |  |
| **5** | So that more energy can be transported to the muscles. |  |  |  |  |

*Biology> Big idea BCL: The cellular basis of life > Topic BCL2: From cells to organ systems > Key concept BCL2.3: The human skeleton and muscles*

|  |
| --- |
| **Diagnostic question** |
| **Exercise** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Bones and muscles are tissues that work together with organs in organ systems to support the life processes of cells to keep organisms alive. |
| Observable learning outcome: | Explain why heart rate increases when we exercise. |
| Question type: | Confidence grid |
| Key words: | circulatory system, gas exchange system, muscle |

**What does the research say?**

It is a common misconception that air and oxygen are the same thing (Driver et al., 1994). Some children believe that muscles need ‘air’ (rather than oxygen) to work; related misconceptions are that the heart pumps air around the body instead of or in addition to blood, and that the heart rate increases during exercise so that the heart can pump more air to the muscles (Allen, 2014).

Students at age 11 are usually aware that ‘air tubes’ link the mouth to the lungs, and that humans have two lungs located in the chest (Bartoszeck, Machado and Amann-Gainotti, 2011; Allen, 2014). However, some students also believe that similar ‘air tubes’ connect the lungs to the heart, and that this explains how oxygen from air enters the blood.

**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 PowerPoint presentation with an electronic voting system or mini white boards.

*Differentiation*

You may choose to read the question and answers 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. So that the heart can pump more air to the muscles – **wrong** (the heart pumps blood, not air, and the blood carries oxygen, not air)
2. So that more carbon dioxide can be transported from the lungs to the muscles – **wrong** (carbon dioxide is transported from the muscles cells, where it is made as a waste product of cellular respiration, to the lungs, where it is released from the blood for exhalation)
3. So that more oxygen can be transported from the lungs to the muscles – **right**
4. Because there is a faster rate of cellular respiration in the muscles – **right**
5. So that more energy can be transported to the muscles – **wrong** (working muscle cells gain energy from cellular respiration; energy is not transported in the blood)

**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 (meaning making) through dialogue.

If students have misunderstandings about the links between the gas exchange system, circulatory system and the rest of the body, key concept BCL2.2 *Supplying cells – the human circulatory, digestive and gas exchange systems* provides diagnostic questions and response activities to further probe and develop understanding.

If students have misunderstandings about the requirements of cellular respiration, key concept BCL3.2 *Cellular respiration* provides diagnostic questions and response activities to further probe and develop understanding.

**Acknowledgments**

Developed by Alistair Moore (UYSEG).

Images: pixabay.com/mohamed\_hassan (2897357)

**References**

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