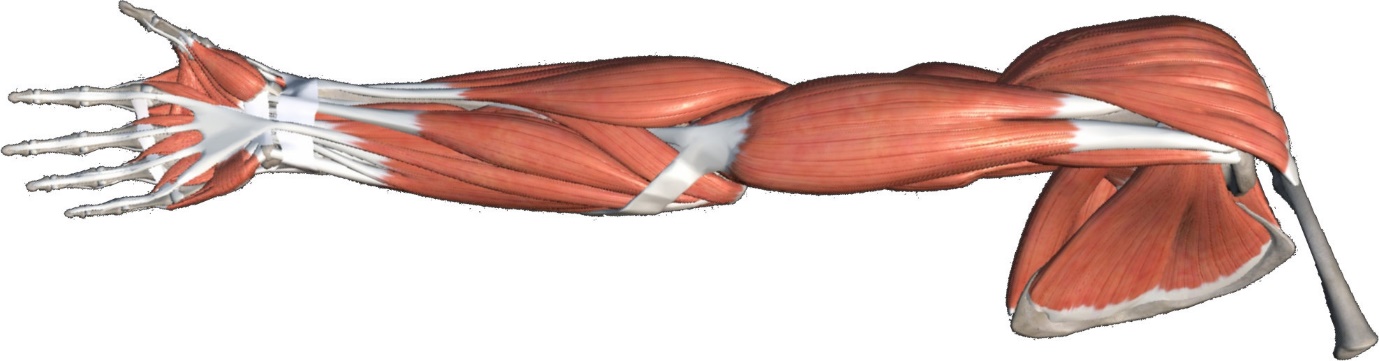
**Are muscles and bones alive?**

There are many muscles and bones in a human arm and hand.



1. What is the best description of a **muscle** in a living human body?

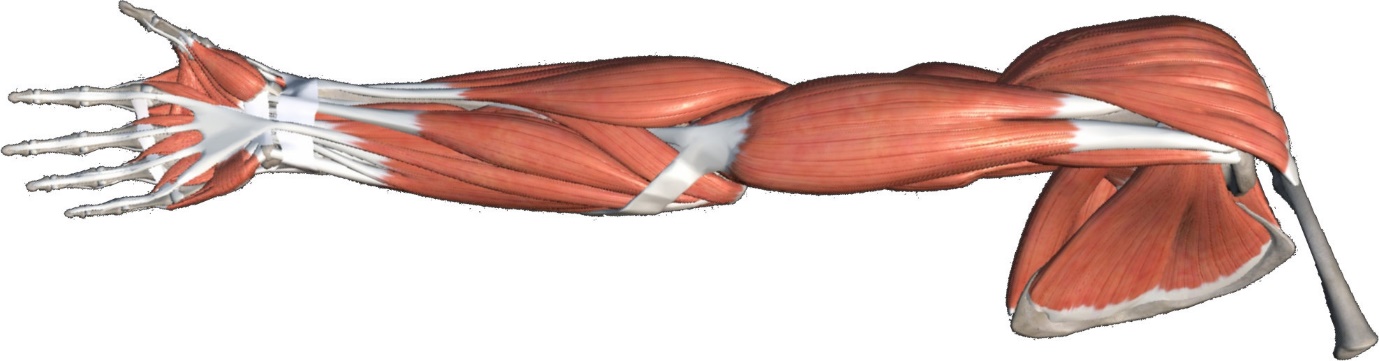
|  |  |
| --- | --- |
| **A** | It is a living tissue. |
| **B** | It is a non-living tissue. |
| **C** | It is not a tissue. |

1. How would you explain your answer to question 1?

|  |  |
| --- | --- |
| **A** | It can move and grow. |
| **B** | It is made up of protein. |
| **C** | It is made up of cells. |
| **D** | It can get hurt. |
| **E** | It is made up of fibres. |

**Are muscles and bones alive?**

There are many muscles and bones in a human arm and hand.



1. What is the best description of a **bone** in a living human body?

|  |  |
| --- | --- |
| **A** | It is a living tissue. |
| **B** | It is a non-living tissue. |
| **C** | It is not a tissue. |

1. How would you explain your answer to question 3?

|  |  |
| --- | --- |
| **A** | It can move and grow. |
| **B** | It is made up of calcium. |
| **C** | It is made up of cells. |
| **D** | It repairs itself if it gets broken. |

*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** |
| **What are muscles?** |

**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: | Recall that bones and muscles are living tissues made up of cells. |
| Question type: | Two-tier multiple choice |
| Key words: | muscle, cells, tissue |

**What does the research say?**

By age 11-14, students should know from science lessons that the bodies of humans and other animals have different parts with specific functions, including bones and muscles, and that these parts are made up of cells (AAAS Project 2061, 2009; Department for Education, 2013).

It is a common misunderstanding amongst people of all ages that bone (even when it is inside a living organism) is dead, perhaps because bones and skeletons are often associated with imagery of death and with specimens in museums etc.; this misunderstanding is reinforced by the fact that bones are usually only seen when they are outside the body, and are usually only alive when they are inside it (Caravita and Falchetti, 2005; Fullick, 2011). Caravita and Falchetti found that growth and movement were the criteria most commonly applied by students to decide whether bones were alive, as well as phenomenological criteria drawn from personal experience such as that bones hurt when injured and repair when broken; few 8-9 years olds mentioned that bones are made of cells, but it was more common in 12-13 year olds.

**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**

1. A – A living tissue
2. C – It is made up of cells.
3. A – A living tissue
4. C – It is made up of cells.

Although alternative options in questions 2 and 4 are true, the best explanation for why muscle and bone are considered living tissues is that they are made up of cells.

**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 whether organisms and their parts are made up of cells, and about how the cells of multicellular organisms are organised into tissues, organs and organ systems that work together to keep the cells alive, key concepts BCL1.2 *Cells and cell structures* and BCL2.1 *Working together – cells, tissues and organ systems* provide diagnostic questions and response activities to further probe and develop understanding.

**Acknowledgments**

Developed by Alistair Moore (UYSEG).

Images: publicdomainpictures.net/Piotr Siedlecki (241963)

**References**

AAAS Project 2061. (2009). *Benchmarks for Science Literacy* [Online]. Available at: <http://www.project2061.org/publications/bsl/online/index.php>.

Caravita, S. and Falchetti, E. (2005). Are bones alive? *Journal of Biological Education,* 39(4)**,** 163-170.

Department for Education (2013). *Science programmes of study: key stages 1 and 2 - National curriculum in England (DFE-00182-2013),* London, UK.

Fullick, A. (2011). Gas exchange, movement and fitness. In Reiss, M. (ed.) *ASE Science Practice: Teaching Secondary Biology.* 2nd ed. London, UK: Hodder Education.