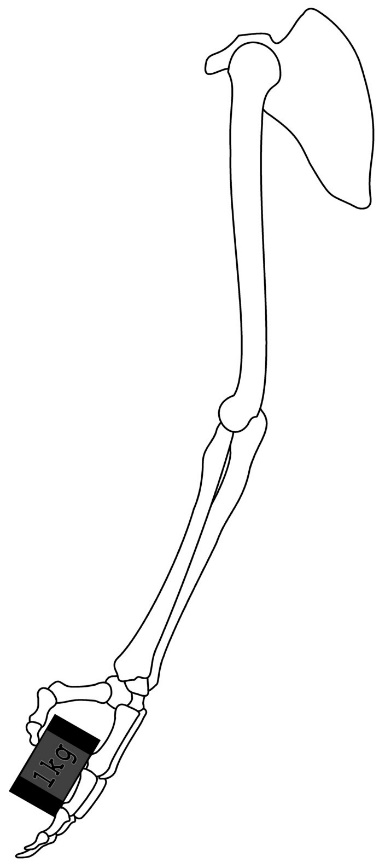
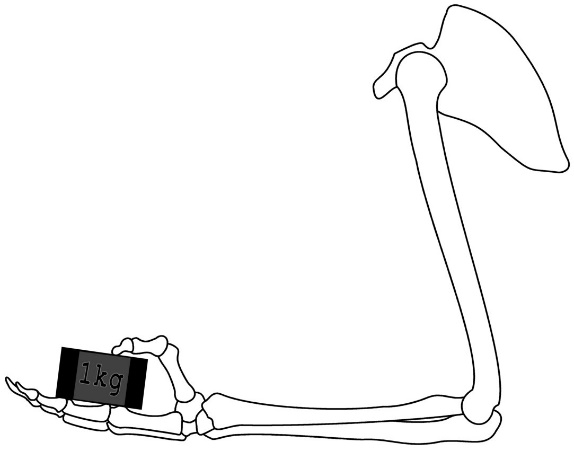
**Visualising muscles and joints**

The biceps and triceps muscles move the radius and ulna bones in the human arm.

**To talk about in your group**

How would you draw the biceps and triceps muscles on the diagrams, below?



scapula bone (shoulder blade)

ulna bone

radius bone

mass

*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*

|  |
| --- |
| **Response activity** |
| **Visualising muscles and joints** |

**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: | Recognise that muscles, including antagonistic muscles, move bones by contracting. |
| Activity type: | Discussion, modelling |
| Key words: | muscle, bone, tissue |

This activity can help develop students’ understanding of how antagonistic muscles work across a joint, and can be used in response to the following diagnostic questions:

* Diagnostic question: Biceps and triceps

**What does the research say?**

Several studies have found that children up to age 20 struggle to appreciate that individual bones are not isolated but are connected to make a functional skeleton (Guichard, 1995; Tunnicliffe and Reiss, 1999). While young children only recognise the supportive and protective (static) functions of the skeleton, older children understand that the skeleton is necessary for movement; however, only one fifth of the older children in one study could draw muscles correctly across a joint (Caravita et al., 1988).

Use of real muscles and bones (e.g. in student’s own limbs and in raw chicken legs) and models can help children to understand this more effectively, including the idea that muscles can only pull (Haddad, 1995; Goodwyn and Salm, 2007; Fullick, 2011).

**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 muscles 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 muscles on the diagrams. Then 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*

Prior to starting their drawings, it may be helpful for some students to explore real muscles and bones (e.g. in their own arms, or as a teacher demonstration using raw chicken legs and a visualiser), or to use or build articulated models. This may help them to appreciate how muscles move bones at a joint, including the idea that muscles can only pull (Haddad, 1995; Goodwyn and Salm, 2007; Fullick, 2011).

**Equipment**

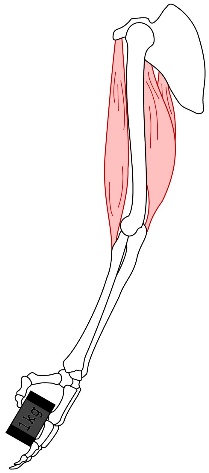
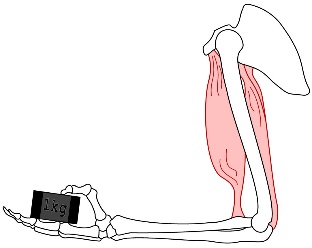
For each pair/group:

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

For demonstration to the class:

* raw chicken legs and visualiser (optional)
* articulated model(s) showing joints and muscles (optional)

**Expected answers**



biceps muscle

biceps muscle

triceps muscle

triceps muscle

**Acknowledgments**

Developed by Alistair Moore (UYSEG), from ideas described by Haddad (1995), Goodwyn and Salm (2007) and Fullick (2011).

Images: UYSEG

**References**

Caravita, S., et al. (1988). Investigating pupils' conceptualization in the biological domain: structure-function relationsships. In Duit, R., Saeljoe, R. (ed.) *Students' conceptions of subject matter content. Proceedings of a symposium at the 2.Eur. Conf. for Research on Learning and Instruction, Tuebingen, Sept. 1987.* Kiel: IPN Reports-in-Brief.

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

Goodwyn, L. and Salm, S. (2007). Modeling muscles. *Science Teacher,* 74(9)**,** 49-52.

Guichard, J. (1995). Designing tools to develop the conception of learners. *International Journal of Science Education,* 17(2)**,** 243-253.

Haddad, R. (1995). Teaching about muscles: are your students flexing their minds as they extend their knowledge? *American Biology Teacher,* 57**,** 178-80.

Tunnicliffe, S. D. and Reiss, M. J. (1999). Students´ understanding about animal skeletons. *International Journal of Science Education,* 21(11)**,** 1187-1200.