

**AF1 LAT: TASK SHEET (LEVELS 3-6)**  
**ARE BONES LIVING?**

Milly and Molly were watching their dog eat a bone.

They were wondering if the bone was living or non-living.



**Molly:** The bone was never alive, it is just part of a living thing - like hair.



**Milly:** The bone was alive because it came from a living thing.

**TASK**

Molly and Milly sent you an email to ask if you could help them answer this question.

Write an email to Molly and Milly to explain whether you think a bone is living or non-living.

*Use the Information sheet or Access sheet to help you.*

*For Levels 3-4 use the Access Information Sheet.*

**Include:**

- Ideas from the model(s) to help you decide
- Decide with whom you agree, Molly or Milly
- Use scientific evidence to support your answer
- How scientists came up with the models
- Discuss how sure you are about your answer
- Write in as much detail as you can

**Key words**

alive, bone, cell, dead, evidence, living, model, non-living, support, refute

What is your target level? Use the level ladder to help you reach it:

To get level	You might:	AF1
<b>3</b>	<ul style="list-style-type: none"> <li>Compare the bone to a living organism and non-living object.</li> <li>Decide who you agree with, Milly or Molly.</li> <li>Use parts of the MRS GREN model to help you answer.</li> <li>Use one piece of scientific evidence to support your answer.</li> </ul>	3.1
		3.2
		3.3
		3.4
<b>4</b>	<ul style="list-style-type: none"> <li>Describe which MRS GREN processes the bone displays.</li> <li>Use MRS GREN to decide whether the bone is living.</li> <li>Identify one piece of evidence that supports that the bone is living or not living.</li> </ul>	4.1
		4.2
		4.3
<b>5</b>	<ul style="list-style-type: none"> <li>Describe two of the MRS GREN processes in more than one sentence each.</li> <li>Explain your answer using the idea of cells.</li> <li>Recognise why it is difficult for scientists to state definitely that bones are living or not living.</li> <li>Identify creative thinking by scientists who developed models of life.</li> </ul>	5.1
		5.2
		5.3
		5.4
<b>6</b>	<ul style="list-style-type: none"> <li>Explain whether bones are living or non-living using the models of living things.</li> <li>Identify the problems with the MRS GREN model.</li> <li>Describe how the existence of cells supports or refutes the MRS GREN model.</li> <li>Explain scientists have changed their views about the model of life as new discoveries were made.</li> </ul>	6.1
		6.2
		6.3
		6.4

**AF1 LAT: TASK SHEET (LEVELS 6-8)**  
**ARE BONES LIVING?**

Milly and Molly were watching their dog eat a bone.

They were wondering if the bone was living or non-living.



**Molly:** The bone was never alive, it is just part of a living thing - like hair.



**Milly:** The bone was alive because it came from a living thing.

**TASK**

Molly and Milly sent you an email to ask if you could help them answer this question.

Write an email to Molly and Milly to explain whether you think a bone is living or non-living.

*Use the Information sheet and Timeline to help you.*

**Include:**

- Logical use of Ideas from the models to help you decide
- Decide with whom you agree, Molly or Milly
- Use scientific evidence to support your answer
- How scientists came up with the models
- Discuss how sure you are about your answer
- Write in as much scientific detail as you can

Refer to the level ladder to ensure that you reach your target level.

**Key words**

abstract model, acceptance, alive, bone, cell, dead, evidence, living, model, non-living, support, systematic, refute

What is your target level? Use the level ladder to help you reach it:

To get level	You might:	AF1
<b>6</b>	<ul style="list-style-type: none"> <li>Explain whether bones are living or non-living using the models of living things.</li> <li>Identify the problems with the MRS GREN model.</li> <li>Describe how the existence of cells supports or refutes the MRS GREN model.</li> <li>Compare the MRS GREN model to the cell model and which you think scientists might prefer.</li> </ul>	6.1
		6.2
		6.3
		6.4
<b>7</b>	<ul style="list-style-type: none"> <li>Explain clearly whether you think bones are living or non-living making clear reference to the models.</li> <li>Systematically use the models to decide which is best to explain your answer.</li> <li>Explain the evidence that supports your answer.</li> <li>Explain why you cannot fully answer the question.</li> <li>Explain the processes by which the cell model or DNA structure was accepted by the scientific community.</li> </ul>	7.1
		7.2
		7.3
		7.4
<b>8</b>	<ul style="list-style-type: none"> <li>Explain whether you think bones are living or non-living, logically and in detail, making use of abstract ideas and models from different areas of science.</li> <li>Select and justify an appropriate approach to evaluating the relative importance of a number of different factors in your explanations.</li> <li>Analyse the development of theories of life through the emergence of new, accepted ideas and evidence.</li> </ul>	8.1
		8.2
		8.3

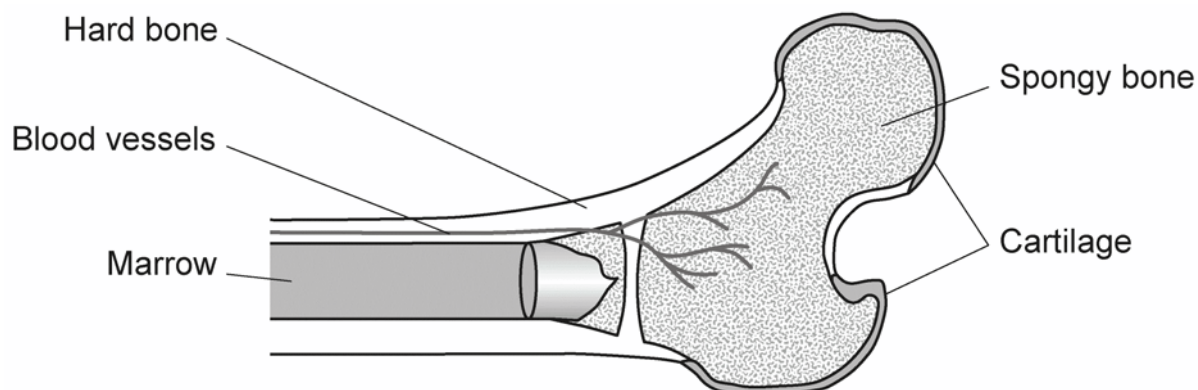
# 1.3

## AF1 LAT: ACCESS INFORMATION (LEVELS 3-4) FACTS ABOUT BONES

Bones are made up of different parts. They are not completely solid.

They have a hard outer layer and inside softer bone marrow.

Only some animals have bones. Not all living things contain bones.



Bones grow during childhood. When you are fully grown the bones continue to repair.

If you break a bone, it takes the body about 6 weeks to repair it.

Bones have blood vessels to bring oxygen and nutrients to them. Bone cells excrete carbon dioxide as a waste chemical.



### A MODEL FOR THE CHARACTERISTICS OF LIFE

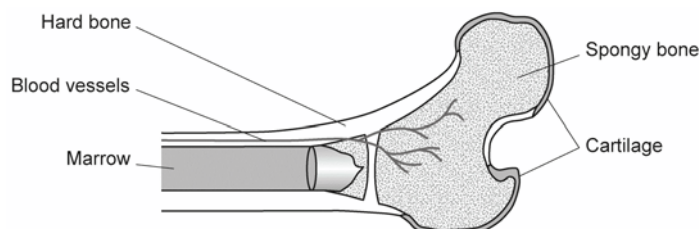
#### MRS GREN

The MRS GREN model states that a living thing does all seven things.

<b>M</b> Movement	Living things can change position by themselves.
<b>R</b> Reproduction	Mating to make offspring or making copies of itself.
<b>S</b> Sensitivity	Reacts to changes from the outside e.g. sound or light.
<b>G</b> Growth	Grows to get bigger or to repair.
<b>R</b> Respiration	Uses oxygen and food together for energy.
<b>E</b> Excretion	Produces waste chemicals.
<b>N</b> Nutrition	Uses food or makes its own.

### FACTS ABOUT BONES

- Bones are made up of different parts. They are not solid. They have a hard outer layer and inside softer bone marrow. The head of the bone contains spongy cells.



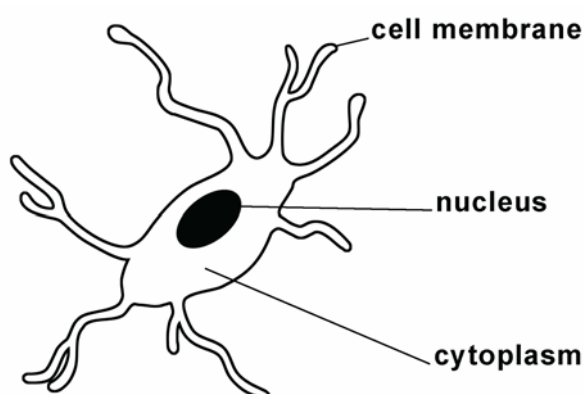
- Bone is made up of 70% minerals (calcium compounds) and 30% cells and other organic materials.
- Bones grow during childhood. When you are fully grown the bones continue to repair. If you break a bone, it takes the body about 6 weeks to repair it.
- Bones have blood vessels to bring oxygen and nutrients to them. Bones cells excrete carbon dioxide as a waste substance.

### A MODEL FOR THE CHARACTERISTICS OF LIFE

**MRS GREN:** The MRS GREN model states that a living thing does all seven things.

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### THE MODEL OF THE CELL



The cell model states that all living things are made of cells and substances made by cells.

Bone cells are called osteocytes.

Osteocytes are specialised cells that build bone; some take calcium from the blood and build it into bone.

All osteocytes contain genetic material, DNA in their nucleus.

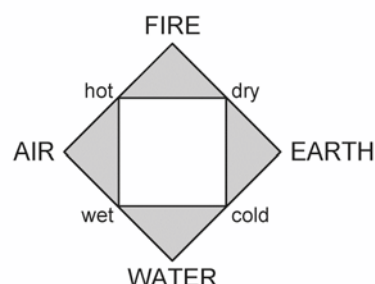
# 1.3

## AF1 LAT: INFORMATION SHEET (LEVELS 6-8) TIMELINE

### Our first theories about living things.

Early Greeks believed that life was caused by the right combination of the four elements: earth, air, fire and water.

Some people still believe in 'life force'. This is believed to be an 'energy' that gives an object life. This idea is not supported by scientific evidence.



### Biological theories

Biologists began to list the characteristics that are common to all living things.

There are several models used for this e.g. the **MRS GREN** model.

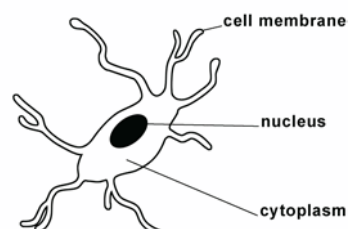
Using the MRS GREN model, something is thought to be living if it has most or all of the characteristics listed. There is no agreement on a single list of characteristics.

### Discovery of the cell

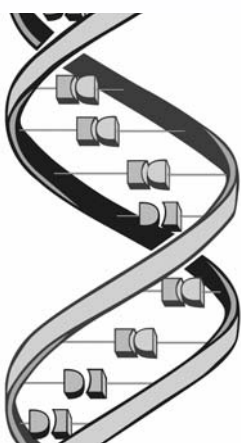
The scientist Robert Hooke first described cells in his book in 1665. Although several scientists had already been observing microscopic objects using newly invented simple microscopes.

It is now agreed by biologists that:

- all living organisms are made of cells
- cells carry out all the processes of life.
- all cells are produced by another cell.



Most cells contain a nucleus, cytoplasm and membrane. There are many hundreds of different types of cells. Cells make tissues, which make organs, which make systems, which work together to make living organisms.



### Discovery of DNA – 'the chemical of life'

There was a lot of interest in the chemicals that were inside the nucleus of a cell. In 1953, after a lot of work involving several scientists, James Watson and Francis Crick published a paper in the journal *Nature* about the structure of DNA (deoxyribonucleic acid). Since then it is agreed that all living organisms use DNA as a set of instructions to carry out all living processes including, growth, respiration and reproduction. Some scientists question if viruses are living, although they contain DNA.

# 1.3

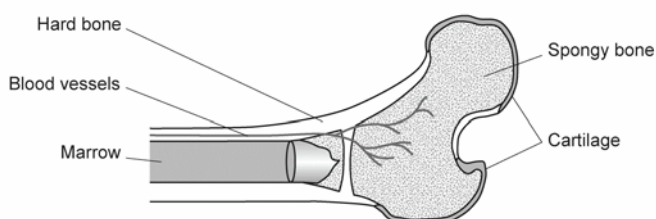
## AF1 LAT: ACCESS WORKSHEET (LEVELS 3-4) IS A BONE LIVING OR NON-LIVING?

Compare a rock and a rabbit to the bone (*Use the Information Sheet: Access to help*).

A rock is non-living because (3.1):



A rabbit is living because (3.1):



I think the bone is non-living ☐

I think the bone is living ☐

Because (3.1):

Decide if a bone has each of the MRS GREN characteristics (4.1 & 4.3).

MRS GREN Characteristics	Write your evidence below:	Yes ✓ No x Unsure ?
Movement		
Reproduction		
Sensitivity		
Growth		
Respiration		
Excretion		
Nutrition		

<b>Molly</b> 'The bone was never alive, it is just part of a living thing – like hair.'		<b>Milly</b> 'The bone was alive because it came from a living thing.'
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I agree with ..... (3.2) because (4.3): .....

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