Organisms, systems, organs and tissues

Links between processes, systems, organs and tissues

Some organisms are very simple, consisting of just a single cell, and others are extremely complicated. But all carry out the seven functions of a living organism. This is often remembered by the mnemonic: MRS GREN which stands for movement, reproduction, sensitivity, growth, respiration, excretion and nutrition. The systems of any organism enable these functions to take place, for example the excretory system, the reproductive system. These systems work in a coherent way to enable coordination and control of the organism.

Organs are individual structures within an organism which carry out one or more specific functions. An organ can comprise more than one sort of tissue but all the tissues contribute to the organ’s function/s. A tissue is made of one type of cell.

The term organ is used for large structures only, which are generally easily visible. Some examples of animal organs are the stomach, the brain, the heart, the liver, the kidney. The heart contains several types of tissue, including specialised muscle tissue, ligament-like structures (the ‘heartstrings’) that prevent the valves from breaking, and connective tissue which helps bind it together.

Some obvious examples of plant organs include the flower, the leaf, the stem, the root.
Understanding the processes

A biological process is simply a process in a living organism. It consists of a number of chemical reactions that result in:

- a change of chemical materials
- transformation of chemical materials
- transport of chemical materials from place to place.

For example, breathing is a biological process that transfers oxygen from outside the body to the blood and the transfer of carbon dioxide from the blood to the outside. Other examples include digestion, reproduction, pigmentation, cell growth and division, tropisms and metamorphosis.

Biological processes are instigated and regulated by genes, hormones and enzymes. Cells must be able to interact with each other and their surroundings to carry out these processes. Materials must be able to get in and out of cells.

Cells, tissues and organs are made of chemicals: many of these chemicals are also found in non-living matter. Some of these chemicals react or combine with each other, or with chemicals from outside the organism, to form other chemicals.

There are two basic types of reaction. One type requires energy and produces more complex compounds and the other releases energy and produces simpler compounds. This is known as metabolism.

Task 4: Linking the systems

Think about digestion! Decide which of the organs below are found in the digestive system and add any others that are not in the pictures.

Make another list of the chemical substances and underpinning processes involved (see the Pathway diagram). Now repeat the task for circulation.
Construct a Venn diagram using two circles, one labelled digestion and one labelled circulation.
Complete this to show any overlaps between these two systems and the processes.

Discuss this with a colleague and see if they agree. Working together, add a third circle for respiration and summarise what you have found out. Reflect on whether this process helps you think about the whole organism. The next task is a classroom activity to find out whether pupils make links between the different systems and processes.
### Task 5: Classroom activity: Do pupils make the links?

Try this task with Year 10 or 11 pupils. Allocate a system to a small group of pupils and ask them to complete the appropriate columns.

<table>
<thead>
<tr>
<th>Name of system</th>
<th>Main organs contributing to system</th>
<th>Main functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digestive system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nervous system</td>
<td></td>
<td></td>
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<tr>
<td>Musculo-skeletal system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excretory system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reproductive system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory system</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now give each small group of pupils a large outline drawing of a human body. Have a few spares! Ask them to draw the shape and size of the organs in the correct position for the allocated system, and annotate the connections between the organs.

If more than one pair has worked on the same system or ask them to compare their drawings and give feedback to each other on the accuracy of their drawings. If you have a torso model or skeleton of the human body this would be a good time to match the drawings to the model.

Display the systems around the room and invite pupils to look at each one and identify which have one or more organs in common with the system they looked at. Finally, ask pupils to discuss links between the different systems in order to produce a coordinated working organism.

Ask pupils to decide the best way to present and display this information for a particular audience.

After the lesson:

- Reflect on the accuracy of the drawings, particularly positioning and size, and what this tells you about your pupil’s ideas.
- Do you think pupils had made links between the different systems previously?
- Are there changes to the way systems and organs are taught in Key Stage 3 that need to be made to help pupils make the links more explicitly?
There are a number of underpinning processes identified in the pathway above:

- Why do you think they are called underpinning processes?
- Are there any missing processes?
- The pathway is a model used to represent the bigger picture of life processes. What are the strengths and weaknesses of the model?