**The battle for fortress plant**

**Teaching Notes**

### ****Introduction and context****

### **Ideas about communicable diseases in plants are included in the updated programmes of study for Key Stage 4 biology published in December 2014. These ideas will be included in GCSE science courses from 2016 (for first assessment in summer 2018).**

### **This bundle of resources will help develop the following learning outcomes at KS4:**

### **describe physical plant defences**

### **describe chemical plant defence responses.**

### **Note that these learning outcomes are required by GCSE Biology, but are not required by GCSE Combined Science.**

### Teaching Notes

### **The poster ‘The Never-Ending Battle for Fortress Plant’ illustrates ideas about plant defences against pathogens. It depicts the plant as a fortress which is defended against invading pathogens. The poster is accompanied by a presentation, which can be used as a step-by-step walkthrough of the ideas in the poster.**

### **Encourage students to discuss the analogy and the ideas depicted in the poster. If necessary, emphasise that a plant is not shaped like a fortress, but like a fortress it is well defended against invasion (infection). A discussion about size and scale may also be useful – the illustrations on the poster are not drawn to scale; point out that bacteria are many times smaller than plant cells, viruses are many times smaller than bacteria, and that a whole plant contains trillions of cells.**

### **Also provided is a student sheet with questions that will provide evidence of learning. Later questions require students to draw in ideas from other parts of the GCSE Biology curriculum, including ideas about the inputs and outputs of photosynthesis, transpiration, food chains, the interdependence of organisms and ecosystem services.**

### ****‘Jigsaw groups’ activity****

### **The poster and presentation could be used as the basis for a ‘jigsaw groups’ activity in the classroom.**

### **For example:**

1. Organise students into four "expert" groups to look for specific information in the poster and presentation.

* Group 1 looks for information about physical plant defences against pathogens.
* Group 2 looks for information about how pathogen can invade and infect plants.
* Group 3 looks for information about how pathogens damage plants once inside.
* Group 4 looks for information about how plant cells respond to infection.

1. In each group, the students produce a list of bullet points to summarise the information they have found.
2. The students then re-arrange into ‘jigsaw’ groups to disseminate the information they have found. Each ‘jigsaw’ group should contain at least one person from each of the original groups.

There is more information about the ‘jigsaw groups’ method for cooperative learning at: <https://www.teachervision.com/group-work/cooperative-learning/48532.html>

### Answers to questions

1. All four boxes should be ticked.
2. Cell wall(s) and (waxy) cuticle.
3. “On the outside surface of the plant” should be ticked.
4. Through open stomata; direct puncturing of the plant tissue (by growing though it by means of an infection peg) and using enzymes to dissolve their way in.
5. Sentence 1: “membranes” should be crossed out and replaced with “walls”.

Sentence 2: “antibodies” should be crossed out and replaced with “anti-microbial substances”.

Sentence 3: “divide” should be crossed out and replaced with “die” or “commit suicide” (or words to that effect).

1. Pecking creates a wound: an opening on the plant surface. Fungal spores can be carried to the fruit by wind, water or infected animals (e.g. birds, insects, etc.). The spores germinate, and infect the fruit through the wound, growing inside the fruit, before bursting out onto the surface.
2. Mia is correct. The waxy cuticle forms a waterproof barrier, so is missing from roots which are adapted to absorb water from the soil.
3. Advantages: can absorb carbon dioxide for photosynthesis; can get rid of waste oxygen from photosynthesis; can absorb oxygen for cellular respiration.

Disadvantages: increased risk of infection from pathogens; loss of water by transpiration.

1. Plant defences help plants and trees to stay healthy. Plants are vital for feeding a growing population (food security) and alleviating some of the effects of climate change. Humans and other animals are part of food chains that start with plants. We depend on healthy plants for food and other ecosystem services such as providing timber and other useful materials, medicines, habitats, and breathable air.

**Acknowledgements**

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