UNIT 6: Reproduction in plants

Recommended Prior Knowledge: A basic knowledge of cell structure will be helpful, but otherwise the Unit requires very little previous knowledge.

Context: This Unit introduces the concept of reproduction that will be developed further in Unit 7.

Outline: In this Unit, general features of both asexual and sexual reproduction are considered, before looking in detail at sexual reproduction in plants. The Unit should therefore be covered at a time of year when suitable flowers are likely to be available. It is suggested that mitosis and meiosis are briefly dealt with here, as they help with the interpretation of the distinction between asexual and sexual reproduction, although some teachers may prefer to leave this until genetics is covered. This Unit could be combined with Unit 7, Reproduction in humans.

	Learning Outcomes	Suggested Teaching Activities	Online Resources	Other resources
III 1.1	Define *asexual reproduction* Describe asexual reproduction in bacteria, spore production in fungi and tuber formation in potatoes.	Ensure that students understand that 'asexual' means 'not sexual'. Asexual reproduction involves only one parent, which produces new organisms by mitosis. Fungal spores can be easily seen on bread moulds or mushroom gills, if these are allowed to develop well past the edible stage. Forethought is required to demonstrate asexual reproduction in potatoes, but apart from the time factor it is easy to demonstrate that planting one potato results in the production of many more.		
III 3.2	Describe mitosis simply, in terms of the exact duplication chromosomes resulting in identical daughter nuclei (details of stages are not required).	Although students have no knowledge of genetics yet, they will probably be aware that the nucleus of a cell contains chromosomes, and that these carry genes. Mitosis is a type of cell division that produces cells with identical chromosomes and genes to the parent cell. A simple series of diagrams showing how chromosomes behave during mitosis, with no names of stages, or details of spindles and so on, is all that is required.	Mitosis http://www.iacr.bbsrc.ac.uk/notebook/courses/guide/mitosis.htm Rather more detailed than is required at this level, but nevertheless students may enjoy visiting this site.	

III 1.2	Define sexual reproduction.	Sexual reproduction should be described as a process in which gametes fuse together in a process called fertilisation, producing a zygote. Make sure that students understand that this need not always involve two parents – self-fertilisation, which is not uncommon in plants, is still sexual reproduction. Unlike asexual reproduction, sexual reproduction introduces genetic variation amongst the offspring.		
III 3.3	Describe the production of gametes by meiosis simply, in terms of halving of chromosome number leading to variation (details of stages not required).	Students should think about how chromosome number can be kept constant during sexual reproduction, and discussion will probably bring out the idea that gametes must have only half the normal number of chromosomes if the zygote is to end up with the right number. The description of meiosis should be kept as simple as possible, concentrating on its results rather than any details of the process itself. It is probably best for extension candidates not to attempt to compare sexual and asexual reproduction until they know a little more about the latter process.		
III 1.2.1	Describe the structure and functions of the flower of a named dicotyledonous plant. Define *pollination* and name the agents of pollination. Compare the different structural adaptations of insect-pollinated and wind-pollinated flowers.	Students should look closely at the structure of a simple, radically symmetrical insect-pollinated flower. They can dissect it to find all the different parts, and think about their functions. This is a good opportunity to develop or assess the practical skills of observation and recording. Samples of insect-pollinated and wind-pollinated flowers (grasses and cereals are	What is a flower? Pollination http://www.thinkquest.org/library/lib/site_sum_outside.html?tname=3715&cid=2&url=3715/flower.html%3ftqskip1=1&tqtime=0812	

		good examples of the latter) can be studied and compared.		
III 1.2.1	Describe the growth of the pollen tube and the process of fertilisation. Describe the formation of seed and fruit and the structure of a non-endospermic seed.	Students could try growing pollen tubes. Fertilisation should be dealt with simply, There is no need for details of embyrosacs or all the different nuclei involved. However, do try to avoid the common misconception that the entire pollen grain moves down the style, or that the pollen is the male gamete. If possible, students should be able to watch a flowering plant through all the stages from flowering through to fruit and seed development. This helps them to understand how fruits and seeds develop after fertilisation. The structure of seeds should be investigated practically. Soaked bean seeds are large and easy to see.	Pollen tube growth http://www-saps.plantsci.cam.ac.uk/worksheets/ssheets/ssheet4.htm A method for investigating the growth of pollen tubes.	
III 1.2.1	Define *dispersal of seeds and fruits.* Describe seed and fruit dispersal by wind and by animals.	A range of fruits should be looked at and the ways in which they are dispersed considered. A very common error is to confuse pollination with seed or fruit dispersal and care should be taken to avoid this.		
III 1.2.1	Discuss the advantages and disadvantages to the species of asexual reproduction. Discuss the advantages and disadvantages of sexual reproduction.	Now that they have looked at examples of both asexual and sexual reproduction, extension candidates should be able to consider the advantages and disadvantages of each process.		

III 1.2.1	Discuss the implications to a species of self pollination and cross pollination.	This topic is difficult to deal with at this level, especially as genetics and evolution are yet to be covered. However, extension candidates should be able to consider them in terms of the degree of variation amongst offspring, and begin to think about the effects this might have on populations. Ensure that the emphasis is on the species itself, not on advantages or disadvantages to farmers or gardeners who grow the plants.		
III 2	Describe the environmental conditions affecting germination.	This is an excellent opportunity for candidates to design a simple investigation for themselves. Note that most of the seeds that are used in laboratories are derived from crop plants, and these do not normally require light for germination. However, light is commonly required for the germination of the seeds of other plants.	Investigating seed germination http://www-saps.plantsci.cam.ac.uk/worksheets/ssheets/ssheet5.htm	
III 2	Define *growth* in terms of increase in dry mass. Define *development* in terms of increase in complexity.	The germination and subsequent growth of seedlings can be used as an illustration of growth and development, and students could carry out simple investigations into this.	Morphology and growth of the rice plant http://www.riceweb.org/Plant.htm	