

## Section 8 Ideas and evidence

### Chapter 40 Development of biological ideas

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1. It was not until 1660 that a microscope was developed which was powerful enough to see the capillaries connecting arteries to veins.
2. Harvey's ideas were rejected simply because they contradicted the work of a 2<sup>nd</sup> century physician, Galen.
3. **a** The current theory is that, in the right conditions over the past 400 million years or more, the bodies or parts of bodies of animals and plants became preserved in sedimentary rocks or other suitable deposits.
  - b** It was not the *origin* of fossils which was disputed but rather the interpretation of their significance in terms of evolution or creation. The question is misleading.
4. The advantage of the Linnaean system of naming organisms is that it attempts to put them into related groups in a way that leads to a natural classificatory system. Also, giving organisms 'Latin' names meant that everyone would know exactly which organism was being described, rather than having many different names for the same organism.
5. **a** Mendel concluded that:
  - (i) characteristics can be inherited,
  - (ii) one characteristic could be dominant over another,
  - (iii) with a pair of contrasting characteristics only one can appear in the organism,
  - (iv) a recessive characteristic which is not expressed in the first generation, can still appear in the second generation. It does not 'disappear',
  - (v) the characteristics are transmitted by the gametes.
  - b** Mendel published his findings but in a local journal that was not widely circulated.
6. **a** Lamarck's theory supposed that variations which developed during the life-time of an organism could be inherited. Darwin thought that the variations developed by chance and were heritable.
  - b** They both believed that beneficial characteristics could be inherited and lead to the development of more successful organisms. They thought that the process took place by very small changes and was continuous.
7. The discovery of mutations showed one way by which variations could arise and be inherited.
8. **a** It was shown by experiment that the appearance of maggots in meat was not spontaneous generation but the product of blowflies laying eggs in the meat. The eggs hatched into maggots.
  - b** Pasteur's experiments showed that if you prevented free access to air, micro-organisms would not appear in boiled meat broth.
9. Pasteur controlled a disease of silkworms by removing all dead and infected individuals so that the disease could not spread to the healthy silkworms. Foot and mouth disease in cattle is similarly controlled by destroying infected individuals but in many cases the whole herd is slaughtered to prevent the disease reaching other farms.
10. Chargaff discovered that in a sample of DNA the number of adenines was always equal to the numbers of thymines, and also that cytosines and guanines were equally matched. This suggested that these bases were paired in the DNA molecule.
11. Maurice Wilkins and Rosalind Franklin carried out X-ray analysis of DNA which suggested the structure of the molecule. Crick and Watson used these results in constructing their model of DNA.

## Chapter 41 Observation and experiment

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1. **1** This may be a matter of simple observation. If the tree trunks in a wood all show algal growth on the south side but nothing on the north side the question is answered for this particular area. If the observations are not so clear-cut you would have to find ways of measuring the areas of algal growth on the north and south sides.

**2** There is no way of measuring degrees of ‘companionship’, so this could not be scientifically investigated.

**3** This is too sweeping a generalisation to be investigated as it stands. You could match groups of boys and girls of the same age and similar physique, (you would not expect a short tubby boy to compete with a tall, slim girl), and specify a range of distances for them to run. Alternatively you could study the results of important junior athletics competitions. This would give results for trained athletes.

**4** This can be investigated experimentally but the generalisation is too great. You would have to refine the question to: ‘Do some seeds need light in order to germinate’?

**5** There will be plenty of anecdotal evidence but little objective evidence. You would need a large cohort of subjects matched for age and conditions, with some used as controls. There would be a wide variety of sources of vitamin C in peoples’ normal diets before any measured supplements could be tested.

**6** This could be investigated scientifically by measured observations, once you have decided the size of the samples to be studied and defined the boundaries of ‘north’ and ‘south’.

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1. **1** This would be based on objective evidence.

**2** This is entirely anecdotal evidence.

**3** As stated, this is anecdotal evidence but could be supported by objective evidence.

**4** This statement must have been based on objective evidence since precise measurements must have been needed.

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1. By selecting areas where dandelions were abundant, Paul will have distorted the results to show far more dandelions than there really are.

2. Throwing the quadrat frame 5 times in one area and 10 times in the other is likely to make the comparison inaccurate because it is trying to influence the results.

3. Estimated population  $35 \times 27/8 = 118$ .

**a** By choosing to sample only a proportion of the ground, the results could be affected by migration of marked individuals out of the area. The area sampled must be confined in some way.

**b** A hotter day might promote more activity in the area but this will affect marked and unmarked individuals equally, so it should not make a significant difference.

**c** If the marking process interfered with the free movement of the marked individuals it could distort the result because the marked grasshoppers will tend to stay in the same place.

**d** If the effect of the anaesthetic persisted into the second day it could distort the results as described in **c**.