

# Chapter 15: Genetics and evolution

## Knowledge organiser

### Theory of evolution

**Evolution** is the gradual \_\_\_\_\_ in the inherited characteristics of a population over time.

Evolution occurs through the process of \_\_\_\_\_ and may result in the formation of new \_\_\_\_\_.

### Process of natural selection

The theory of evolution by natural selection states that

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### Evidence for evolution

The theory of evolution by natural selection is now widely accepted because there are lots of data to support it, such as

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### Extinction

**Extinction** is when there are no remaining individuals of a species still alive.

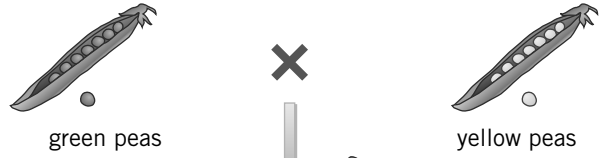
Factors that may contribute to a species' extinction include

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Darwin published this theory in *On the Origin of Species* (1859). His ideas were considered controversial and only gradually accepted because

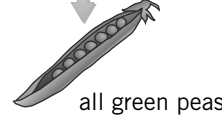
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parents



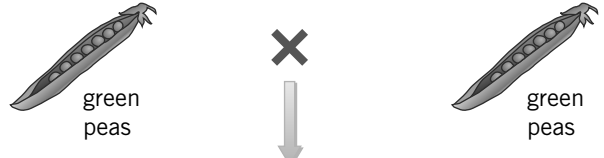
green peas      yellow peas

offspring (first generation)



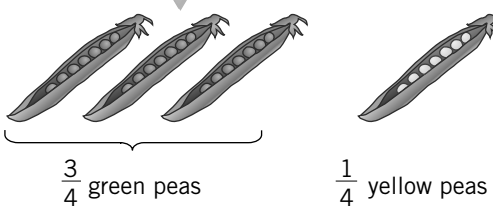
all green peas

but when the offspring are bred ...



green peas      green peas

offspring (second generation)



$\frac{3}{4}$  green peas       $\frac{1}{4}$  yellow peas


### Development of gene theory

Further work by many scientists led to the development of **gene theory**.

In the late nineteenth century the behaviour of \_\_\_\_\_ during cell division was observed.

In the early twentieth century genes and chromosomes were observed to behave similarly, leading to the idea that \_\_\_\_\_ were located on chromosomes.

In the mid-twentieth century the structure of \_\_\_\_\_ and mechanism of gene function were determined.

**Key terms**

Make sure you can write a definition for these key terms.

evolution	extinction	fossil record	natural selection	speciation
	antibiotic-resistance		gene theory	

### Speciation

Alfred Wallace worked with Darwin to propose the theory of \_\_\_\_\_ by natural selection. He is also known for his work on the theory of **speciation**.

Speciation is the gradual \_\_\_\_\_ of a new species as a result of evolution. More evidence and work from scientists over time have led to our current understanding of the theory of speciation.

#### Process of speciation

- 1 two populations of one species are \_\_\_\_\_ (e.g., by a river or mountain range)
- 2 natural selection occurs so that the better-adapted individuals \_\_\_\_\_ and pass on these different characteristics
- 3 the populations have an increasing number of genetic \_\_\_\_\_ as they \_\_\_\_\_ to their different environments
- 4 eventually the two populations are so genetically different they cannot \_\_\_\_\_ to produce \_\_\_\_\_ offspring

### Formation of fossils

- 1 The reptiles \_\_\_\_\_ and fall to the ground.
- 2 The flesh \_\_\_\_\_, leaving the skeleton to be covered in sand or soil and clay before it is damaged.
- 3 Protected, over \_\_\_\_\_ of years, the skeleton becomes mineralised and turns to \_\_\_\_\_. The rocks shift in the earth with the fossil trapped inside.
- 4 Eventually, the fossil emerges as the rocks move and \_\_\_\_\_ takes place.

### Fossils

Benefits of the fossil record	Problems with the fossil record
•	•
•	•
•	•



### Emergence of antibiotic resistance

The development of new antibiotics is \_\_\_\_\_ and \_\_\_\_\_, so is unlikely to keep up with the emergence of new antibiotic-resistant bacteria strains.

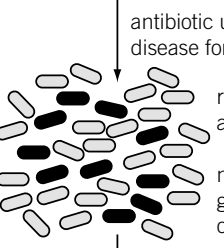
To reduce the rise of antibiotic-resistant strains

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**Key**

-  bacteria not resistant to antibiotic
-  bacteria with mutation giving antibiotic resistance

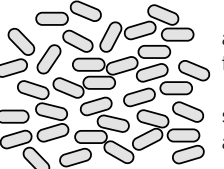
antibiotic used to treat disease for the first time



resistant bacteria grow and reproduce

non-resistant bacteria stop growing and reproducing or are killed

antibiotic continues to be used



all bacteria now resistant to the antibiotic

selection has occurred for antibiotic resistance

# Chapter 15: Genetics and evolution

## Retrieval questions

Answer the following questions using the information from the knowledge organiser.

B15 questions		Answers
1	What is evolution?	
2	Who first proposed the theory of evolution by natural selection?	
3	What is the theory of evolution by natural selection?	
4	Describe Lamarck's idea of inheritance.	
5	Why was the theory of evolution by natural selection controversial?	<ul style="list-style-type: none"><li>•</li><li>•</li><li>•</li></ul>
6	What is speciation?	
7	What evidence supports the theory of evolution?	<ul style="list-style-type: none"><li>•</li><li>•</li><li>•</li></ul>
8	What did Mendel discover through breeding experiments on plants?	
9	What are fossils?	
10	How might fossils be formed?	<ul style="list-style-type: none"><li>•</li><li>•</li><li>•</li></ul>
11	What are the benefits of the fossil record?	
12	What are the problems with the fossil record?	<ul style="list-style-type: none"><li>•</li><li>•</li></ul>
13	What is extinction?	
14	What is the binomial system?	
15	What classification system did Carl Woese introduce?	
16	Why can bacteria evolve rapidly?	
17	How do antibiotic-resistant strains of bacteria develop?	