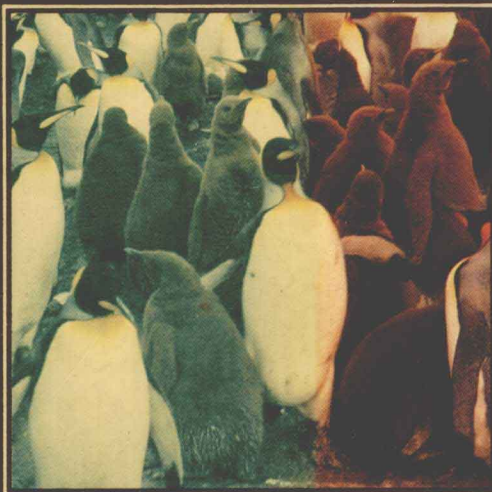
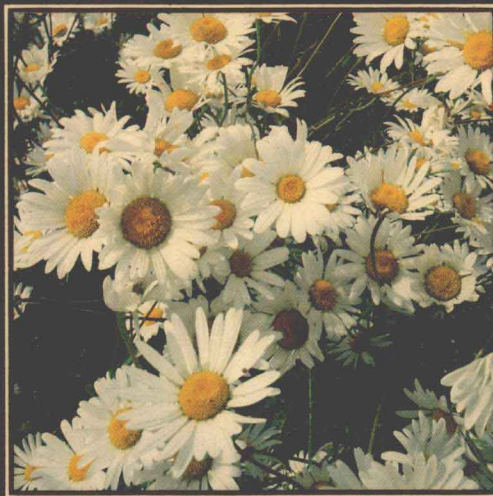
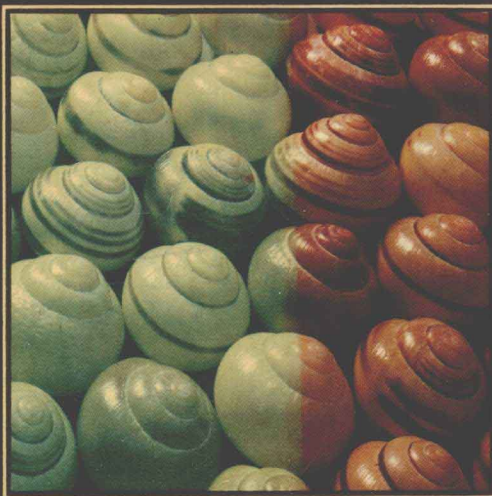
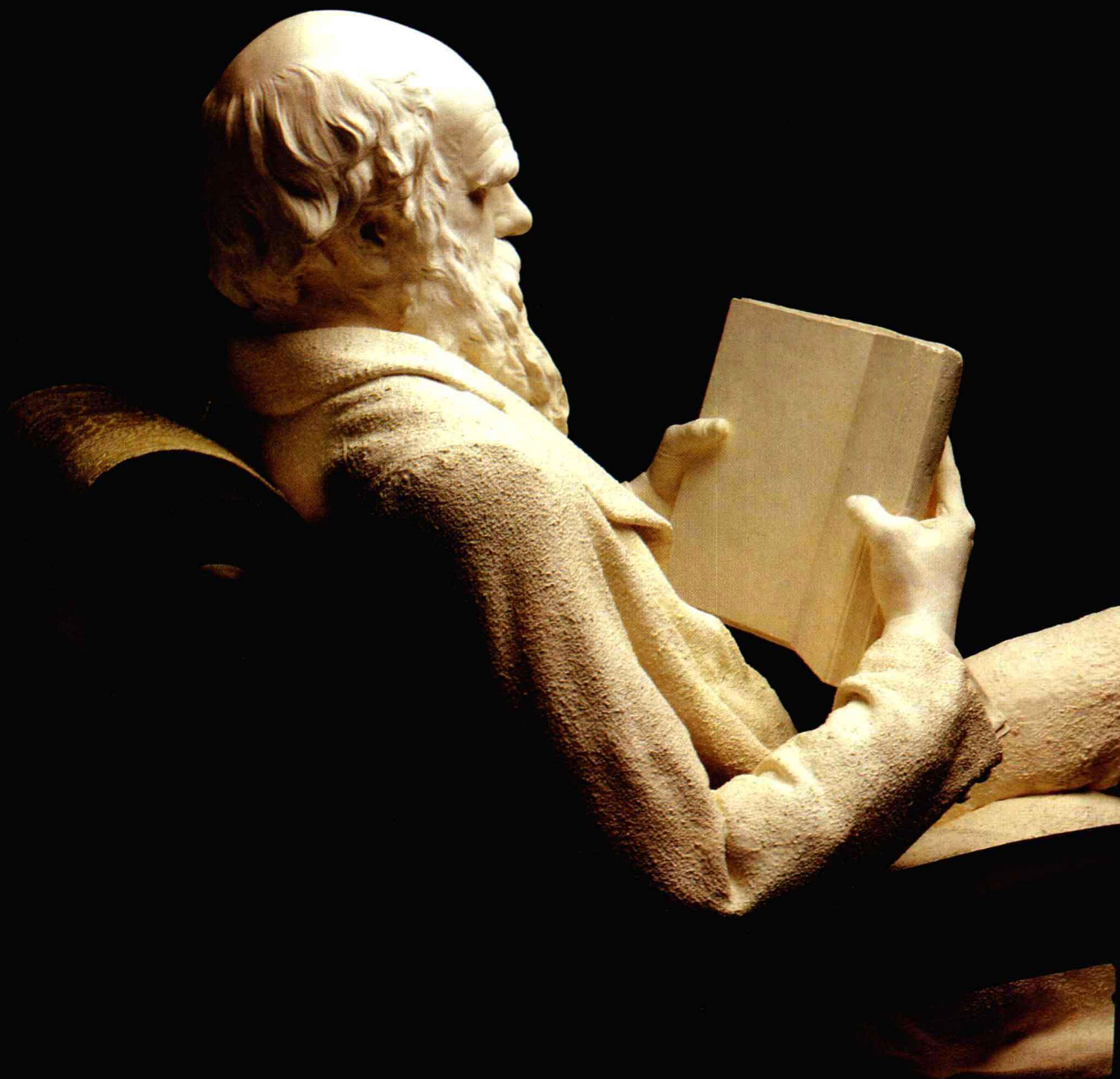


ORIGIN OF SPECIES



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British Museum (Natural History)
Cambridge University Press





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Preface

Every living thing belongs to a species – every plant, every animal, every fungus, every microorganism. But what exactly is a species? And how are new species formed? There are no simple answers to either of these questions, and the origin of species is as hotly debated today as it was when Charles Darwin first published his theory of evolution by natural selection more than 120 years ago.

What is natural selection? How does it work? As readers of this book will discover, natural selection is essentially a very simple idea, and evidence for natural selection can be found amongst living species today. Darwin based his theory of natural selection on four important observations about species – reproductive potential, the effects of the environment, variation and inheritance. **Origin of species** introduces these observations one by one, using a range of examples from the natural world. It then shows how they can be linked to produce the theory of natural

selection, and goes on to examine the role that natural selection might play in the formation of new species.

Throughout the book, the emphasis is on living species, and no attempt is made to reconstruct a history of life on Earth. Moreover, the treatment of genetics is confined to what is needed for a basic understanding of variation and inheritance.

This book is a companion to the major new exhibition **Origin of species**, which will open at the Natural History Museum as part of our centenary celebrations in 1981. Like the exhibition, the book has been planned with the help of experts from the Museum's Scientific Departments, and I should like to take this opportunity of thanking all the people, both within the Museum and outside, who have been involved in its preparation.

R H HEDLEY Director
British Museum (Natural History)
November 1980

Siamese cat
Secretary bird
Stag beetle
Crocodile
Oak Death cap
Spectacled bear
Skua
A. eba
Boomslang
Potato
Cycad
Giant panda
Robin
Dragonfly
Dab
Snake's head
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Ocelot
Shoebill
Praying mantis
Giant tortoise
Broad bean
Horsetail
Lion
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Tiger
Swan
Wasp
Midwife toad
Cannonball tree
Hairy-nosed wombat
Ib
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Mudskipper
Gamboge tree
Yapok
Emu
Blue swimming crab
Electric eel
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Kangaroo
Oven bird
Ant
Piranha
Giraffe
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Hippopotamus
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Slug
Flying fish
Rotifer
Strangler fig
Puffball
Killer whale
Cuckoo
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Stickleback
Breadfruit
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Octopus
Rattlesnake
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Penguin
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Ginkgo
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Flatworm
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Baobab
Zebra
Hummingbird
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Stingray
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Mosquito
Coelacanth
Snapdragon
Camel
Sparrow
Gooseberry sawfly
Frog
Spring beauty
Horse Wren
Desert locust
Caiman
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Badger
Osprey
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Rainbow boa
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Hare
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Slow-worm
Mouse
Limpet
Hammerhead shark
Elephant hawk moth
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Tiger
Swan
Wasp
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Venus's flytrap
Newt
Comb jelly
Dolphin
Water avens
Fanworm
Hare
Pitcher plant

Introduction

Why are there so many different kinds of living things?

One view is that all living things were created just as we see them today, and have never changed. Another view is that the living things we see today have all **evolved** from some distant ancestor by a process of gradual change. But how can evolution have occurred? How could one species have changed into another? Just over 120 years ago, Charles Darwin thought of a way, and called it **natural selection**.

Ever since it was first published, Darwin's theory of natural selection has been one of the most discussed, disputed and misunderstood theories of science. Yet natural selection is a very simple idea, and we can find evidence of natural selection in action in the natural world today.



A corner of the study at Down House, where Darwin worked on his theory of natural selection



Chapter 1

The problem Darwin solved

Even in the middle of the 19th century, evolution was not a new idea. It had been discussed for centuries. But no one could explain how evolution occurred, so the idea was rejected.

Charles Darwin

Charles Darwin is remembered because he thought of a convincing mechanism to explain how evolution might have occurred. He called this mechanism natural selection and described it in his book *On the Origin of Species by Means of Natural Selection*, which was published in 1859.

What made Darwin think about evolution?

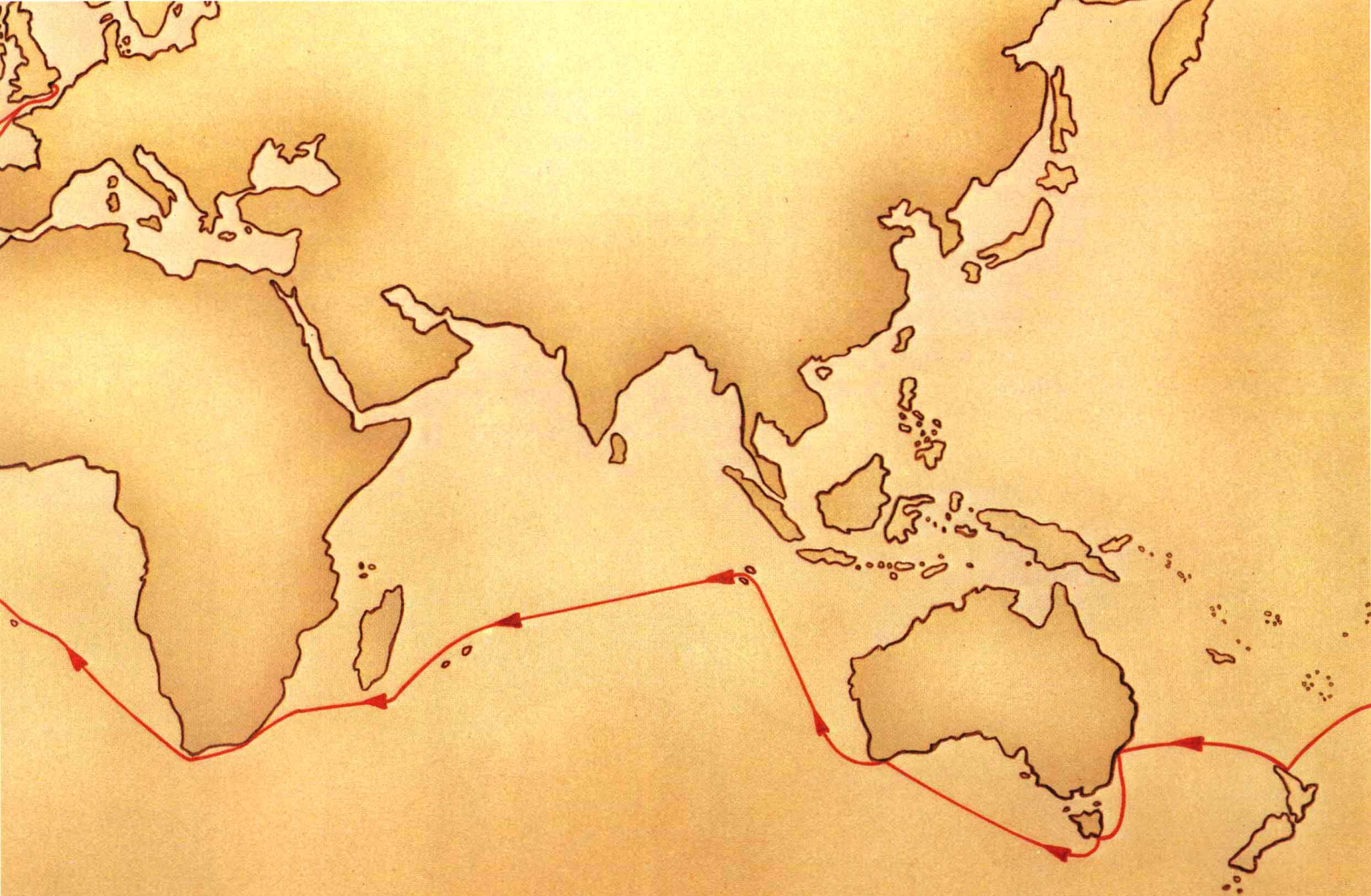
Darwin was expected to follow a career in the church, and he studied for an arts degree at Cambridge University. But he had always been interested in natural history and since boyhood he had avidly collected rocks, flowers and insects. In 1831, soon after he left Cambridge, he was offered a place as a naturalist on the survey ship HMS Beagle. This offer changed his life.

The voyage of
HMS Beagle,
1831-1836

Charles Darwin
(1809-1882)
as a young man

The Beagle

The Beagle's five-year voyage took the young Darwin all round the world. He was amazed by the infinite variety of plants, animals and fossils that he saw, and puzzled about their distribution.



When Darwin returned to England, he began to study the enormous collections of plants and animals he had made during the voyage. He soon began to develop the idea of natural selection, but he was reluctant to publish the theory until he had perfected it. He spent the next twenty years working on his theory and gathering as much evidence as he could.

In 1858, Darwin's studies were interrupted by the arrival of a manuscript from Alfred Wallace, a naturalist working in Indonesia. This manuscript showed that Wallace had independently arrived at the same theory. Darwin and Wallace presented the theory jointly to the scientific world in London, and the following year Darwin published *On the Origin of Species*. The book sold out the day it was published, and caused a storm of controversy because it challenged the accepted views of the time.



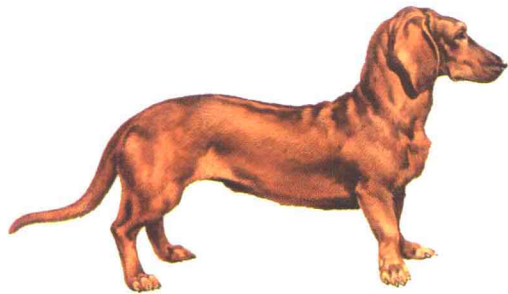
Down House in Kent, Darwin's home from 1842–1882

A clue to Darwin's theory

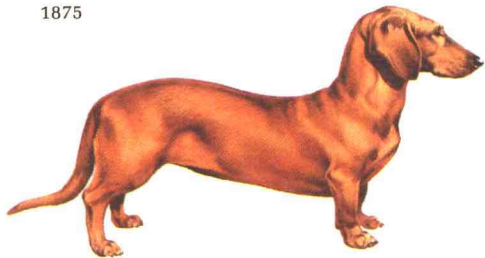
Domesticated plants and animals provided Darwin with an important clue to the way evolution might have occurred.

By breeding together selected individuals, breeders are able to change the characteristics of domesticated plants and animals.

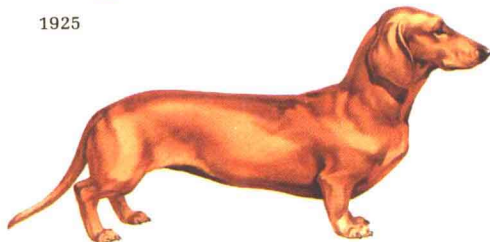
Dachshunds, for example, have changed a lot over the last hundred years or so, as breeders have preferred sleeker, more lightly-built animals with shorter legs and more elegant heads.



1875



1925



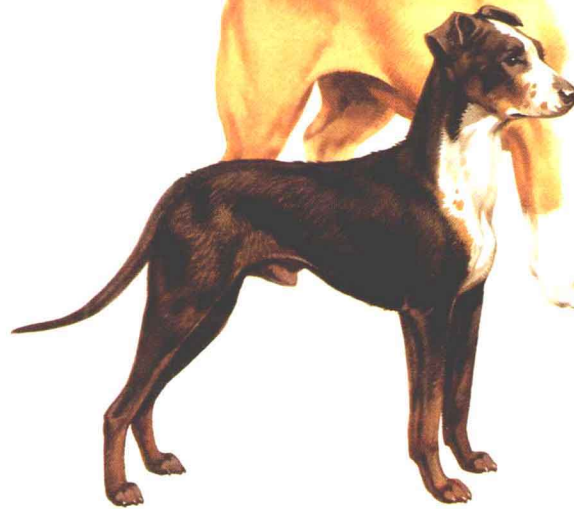
1975

A completely new breed of dog, the Staffordshire bull terrier, was produced by breeding together bulldogs and terriers. From each litter of puppies, breeders selected the ones that had the characteristics they wanted. These animals were then bred together and the process was repeated, generation

after generation, until the breeders had produced the kind of dog they wanted. You can see that the Staffordshire bull terrier combines some of the qualities of both bulldogs and terriers.



bulldog



terrier



Staffordshire
bull terrier



Darwin knew that **domestic selection** over many generations had produced great variety in certain kinds of plants and animals. He thought this might provide a clue to a much more complex process of selection that had been taking place in nature for many thousands of years. He called this process **natural selection**, and thought

that it could account for the great diversity of plants and animals he had seen on his travels.

In the following chapters you can find out more about Darwin's theory of evolution by natural selection, and how it fits in with what we observe in nature.





Chapter 2

How we recognize species

You don't have to travel as far as Darwin did to be amazed at the variety of living things.
Just look around you ...

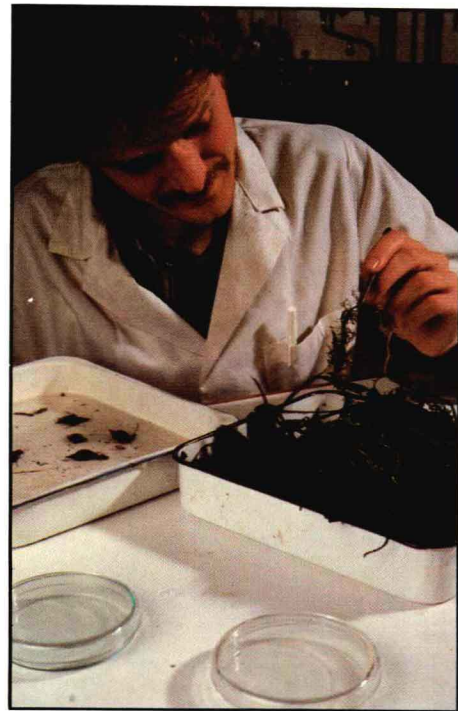
Sorting living things ...

If you search in a pond ...
you will find many different living
things. How would you sort them out?

There are many different ways of
sorting living things. You could divide
them into groups according to their
shape, size, where they live, or how you
think they might feed.

Recognizing species

If you want to recognize different
sorts of living things, you need to put
together the ones that have particular
features in common.



You could start by dividing your
collection into two groups – those that
can move, and those that can't.

The ones that can move are **animals**,
and the ones that cannot move are
probably **plants**.