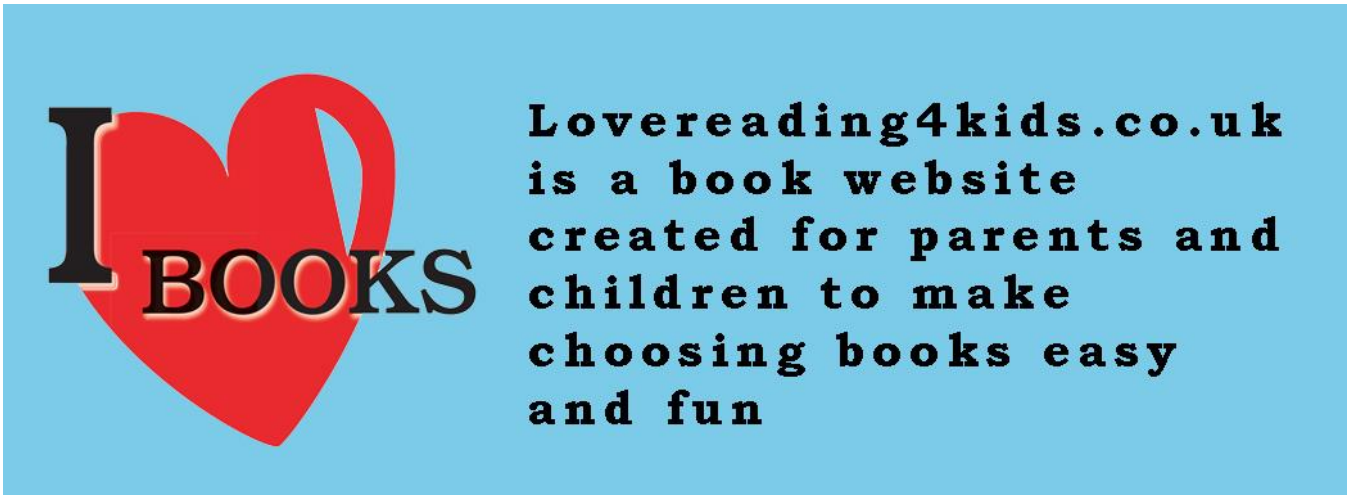

Opening extract from

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Written by

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Dinosaurs!

As any four-year-old will tell you, there is something indescribably cool about dinosaurs, the reptiles that dominated life on Earth for around 135 million years – that's about 100 times longer than humankind has managed so far.

The dinosaurs include the largest animals ever to have walked on land (although not the largest animal ever to have lived – that honour goes to a modern species, the blue whale). But not all dinosaurs were huge – many were rather small, such as *Compsognathus* and *Lesothosaurus*, which were about the size of a large chicken or small goose.

They were a diverse bunch, with species adapted to many of the lifestyles adopted today by birds and land-dwelling mammals – herbivores, hunters, scavengers and omnivores. Dinosaurs could be either solitary or social, and large or small.

Where did they go?

Most of the dinosaurs were wiped out in a **mass extinction** probably triggered by a meteorite strike about 65 million years ago at the end of the **Cretaceous** period. A few that survived went on to diversify into one of the most successful animal groups alive today, the birds.

The distinctive plates of *Stegosaurus* may have had a role in display and temperature regulation – acting like radiator fins.

Tyrannosaurus rex was a hugely successful uber-predator. Fossil remains are widespread and suggest it was one of the last non-bird dinosaurs to go extinct at the end of the Jurassic period.

The largest currently known dinosaur was *Argentinosaurus huinculensis*, estimated at up to 40m long and 50 tonnes in weight.

Know your non-dinos

There are three groups of large reptiles around at the same time as the dinosaurs that are often misleadingly lumped together with them: the flying **pterosaurs** and the marine **ichthyosaurs** and **plesiosaurs**. In fact all three of them have separate origins distinct from the dinosaur lineage.

Are you smarter than a 100 million-year-old?

So, they were around for ages, but were dinosaurs all that clever? Almost certainly not. The infamous velociraptors of *Jurassic Park* had problem-solving intelligence, but the real *Velociraptor* was little more than knee-high to a man, weighed about the same as a small bag of shopping and was probably not much smarter. It also had feathers. In looks and behaviour, the velociraptors depicted in the movies are more like another species, *Deinonychus*, which weighed up to 75kg and may indeed have hunted in packs. If brain size is an indication of smarts, then the brainiest dinosaur might have been the not dissimilar *Troodon*, whose brain-to-body size ratio was comparable to that of modern birds.

EXPERIMENT

Not a drop to drink – turning salt water into drinking water

This simple trick saves lives by magicking potable water where there is none. In some parts of the world distilled seawater is the main source of potable water for whole communities, but you can try it on a small scale in your back garden or on a windowsill.

Desalination is the process of removing salt and other minerals from water, usually seawater. Over 300 million people worldwide rely on it for their drinking water, especially in areas where rainfall and groundwater are limited, such as the Middle East. Desalination on an industrial scale is expensive and uses a huge amount of energy, but a small-scale **solar still** can do the job using just sunshine. It's a technique widely used by survivalists, sailors and the military.

You will need

- A large, deep bowl, like a washing-up bowl
- A small container made of something heavy, like a glass tumbler or short jar
- A sheet of cling film
- A small, heavy object like a pebble or a ball bearing
- 1 litre of seawater (or use tap water mixed with a spoonful of table salt)

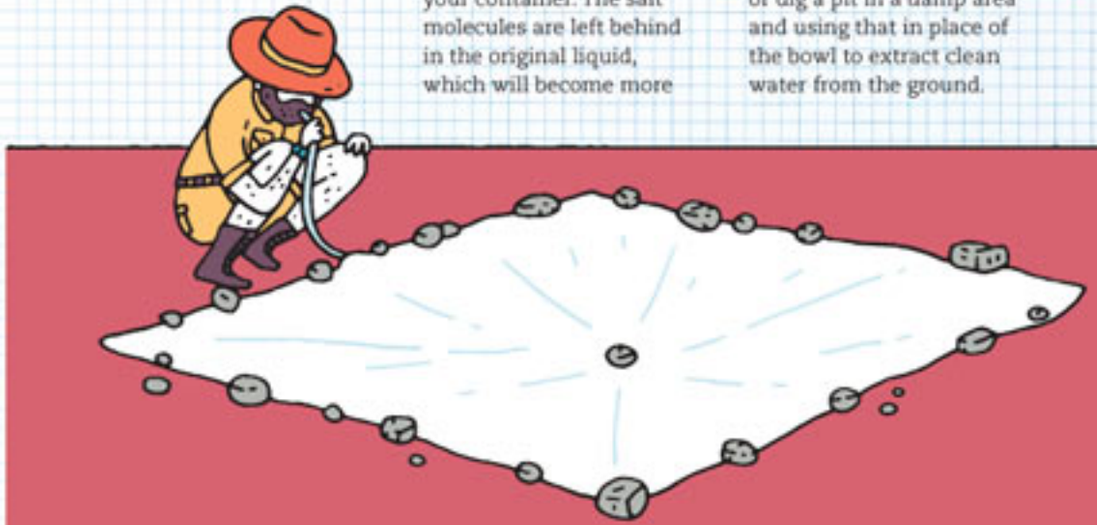
1 Put your salt water in the large bowl, then stand the small container in the middle – the water level should be well below the lip.

2 2 Place the cling film over the large bowl and seal the edges carefully, but leaving it loose enough that you can depress the middle slightly.

3 Place the small weight onto the plastic directly over the small inner container so that it makes a slight depression, then leave the whole contraption in a sunny spot.

What happens next?
The water will begin to evaporate, and the resulting vapour, which is pure H_2O, will **condense** on the inside of the plastic, run down to the low point and drip into your container. The salt molecules are left behind in the original liquid, which will become more concentrated and eventually dry up to a salty crust.

If you're feeling more ambitious you could use a large plastic sheet over much larger containers, or dig a pit in a damp area and using that in place of the bowl to extract clean water from the ground.



EXPERIMENT

A cloud in a bottle

You'll be used to hearing weather forecasters refer to high and low pressures and their associated weather – high pressure generally brings clear, dry conditions and low pressure overcast or wet weather. But how does pressure make a difference?

You will need

- A 2-litre plastic drink bottle, with the labels removed so you can see what's going in inside
- A bottle of isopropyl cleaning or rubbing alcohol*
- A gym ball or spacehopper pump (the kind that looks like a big plastic syringe)
- Vaseline
- Safety specs

1. Specs on! Trickle a little alcohol into the bottle – 5–10ml is plenty.

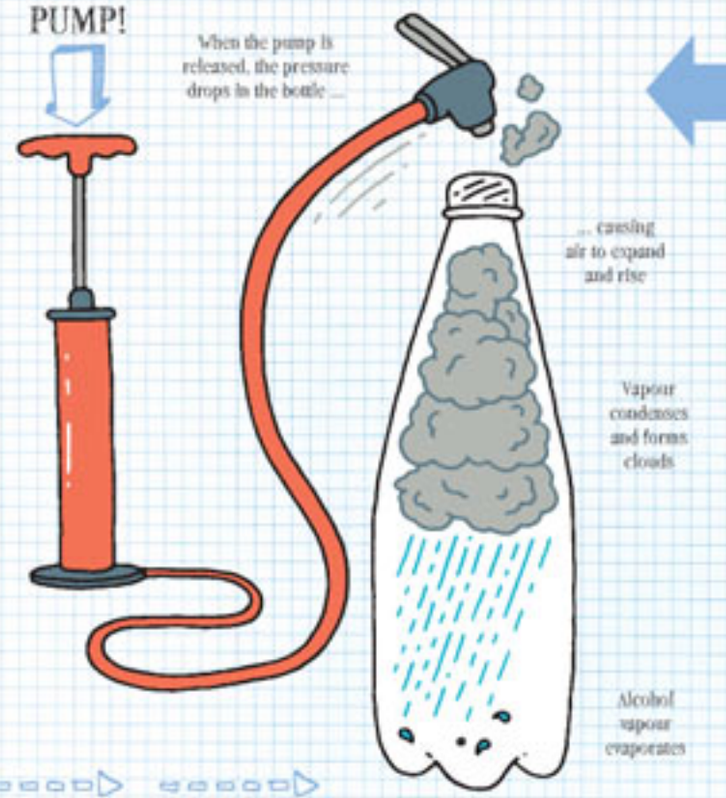
2. Now smear the opening with Vaseline and insert the pump into the neck so that it seals.

3. Pump air into the bottle until you feel firm resistance. You will need to hold the pump in place to keep the seal. Watch carefully what happens in the bottle when you release the seal by removing the pump.

4. Once you've got the hang of making clouds, try dispelling them by replacing the pump and raising the pressure again.

Warning Please, don't be silly enough to try and breathe the cloud – pure alcohol is nasty stuff.

If only changing the real weather was this easy!



What's happening?

Air contains water vapour as a result of evaporation from the surface of the Earth – this is the **humidity** you'll also hear meteorologists talking about. In your bottle, the humidity is created by alcohol vapour. When pressure drops, air expands and rises, leading to a cooling effect, and causing vapour to condense into tiny droplets, forming clouds. When these droplets reach a certain size where gravity can overcome the rising air, they fall as drizzle, rain or snow.

* Alcohol is used for this experiment because it evaporates more quickly and easily than water and thus makes a more dramatic cloud effect. For a more faithful recreation of cloud formation, however, you can perform the same experiment using warm water.

Where did he go? Animal camouflage

Now you see me, now you don't. Camouflage in animals evolved to give them protection when they need it most – which is usually when hunting, or being hunted.

Camouflage ranges from the basic – for example, the generic dowdy brown of many small mammals and songbirds – to the exquisite. The best is able to confound human vision.

Light and shade

Many aquatic animals, especially fish, exhibit **countershading** – a dark upper surface and a pale underside help them blend in with shadowy depths or a bright surface, depending whether they are seen from above or below. Some **bioluminescent** species such as hatchetfish, emit light from their bellies that is the same blue as the sunlight filtering down from above, making them virtually invisible from below.

Blending in

Most camouflage works best against a particular type of background – coarse sand for a flounder, mossy trunks for the mossy-tailed gecko, grass for a grasshopper – but some rather unlikely-looking patterns work well simply by breaking up the animal's outline, for example a tiger's bold stripes.

All change

Some animals change their camouflage on a seasonal basis, for example, Arctic foxes and the grouse-like ptarmigan moult to a coat of winter white. Others change much faster: many fish and frogs darken or lighten their colouring to blend in with their backgrounds. A select group, including chameleons, octopi and squid, are able to match the colour and texture of variable backgrounds with such speed and accuracy that they are effectively cloaked in invisibility. So great is the control some of these animals have over the pigment-containing cells or **chromatophores** in their skin, they can use waves of colour change as a form of communication.

Spot the egg

It's not just animals that are camouflaged: the eggs of many ground-nesting birds are often mottled and streaked so they blend in with their surroundings.

Smells familiar

Camouflage doesn't have to be visual. Cuckoo wasps invade the nest burrows of other wasp species, eat their host's eggs or larvae and replace them with their own. Some are thought to release scents so similar to those of the host that in the darkness of the burrow, they are not recognised.