# A dinosaur in the yard
## Was *Iguanodon* strolling in the sun, or fleeing in fear?

About a week in advance, cut out about eight 'dinosaur foot-shapes' from stiff cardboard, or plywood, scaling them up from the diagram below. They will be used to reproduce the fossil footprints of the hind feet of the Cretaceous dinosaur, *Iguanodon*.

Place each foot-shape on a grassy area, to make a trackway, using the spacing given in the diagram, and hold each one down with weights for a week or so. If possible, the trackway can lead to the bushes, which will give more scope for pupils to use their imagination! Then remove the foot-shapes, and take the class out to see what has happened. The grass should have gone yellow under the foot-shapes leaving a 'dinosaur trackway', which the pupils can investigate.

(Note: If you have no grassy area, cut out just one foot-shape, and use it, shortly before the lesson, to make a trackway in sand, remembering to reverse the foot-shape for left and right feet).

Explain that footprints preserved in the rocks are just as much a type of fossil as the remains of the beast itself, and can be used to gain valuable information. In the case of *Iguanodon*, we know that the hip height of the animal (i.e. the height of the hip joint above the ground) is approximately four times the length of the hind feet. We can also use the length of the animal's stride to find out whether it was walking, trotting or running. These calculations are shown in Figure 1.

Pupils should be asked to measure the size of the footprints and also the stride length. They should calculate the **average** stride length before trying to use the formula to calculate whether the dinosaur was walking, trotting or running.

A cast of the fossil footprint of a hind foot of Iguanodon
*(Photo: P. Murphy, Leeds University)*

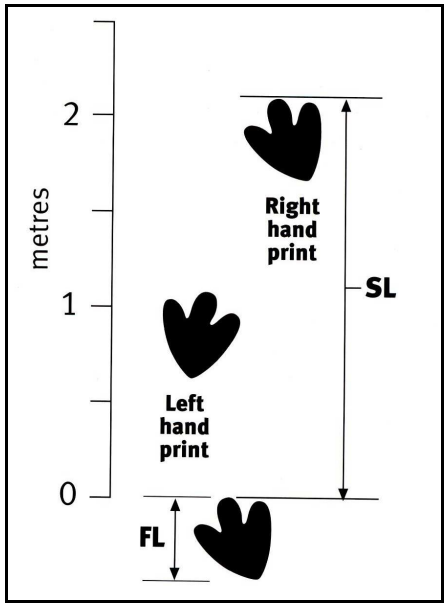


Figure 1: The layout of the dinosaur trackway and the equations needed to calculate the hip height of the dinosaur and its relative speed. (*Diagram after Peter Loader*)

***Key***

FL = length of hind foot
SL = stride length of either right or left hind foot
*h* (hip height) = 4 x length of footprint (FL)
The relative stride length (SL/*h*) is used to determine the gait, i.e. whether the animal was:

Walking (SL/*h* < 2.0)
Trotting (SL/*h* >2.0 and < 2.9)
Running (SL/*h* > or = 2.9)

School pupils measure and record a 'dinosaur trackway' on their school lawn! (*Photo: Peter Loader*)

## The back up

**Title**: A dinosaur in the yard

**Subtitle:** Was *Iguanodon* strolling in the sun or fleeing in fear?

**Topic:** How can the size of a dinosaur's footprints and the length of its stride be used to show how big it was and how fast it was moving?

**Age range of pupils:** 11-18 years

**Time needed to complete activity**: 30 mins + preparation time several days beforehand

**Pupil learning outcomes:** Pupils can:

- measure distances outdoors on open ground, and calculate the average result;
- use a given equation to calculate how an animal might have moved in the past;
- appreciate that such calculations can only give an approximation;
- use their imagination to visualise what could have happened in the geological past.

**Context:** The lesson introduces the concept that an imprint (trace fossil) is just as much a fossil as the remains of the actual body – and can sometimes give very valuable information on the lifestyles of organisms. It provides useful links between physics, mathematics and geology.

**Following up the activity:**

- The 'trackway' can be varied to simulate different speeds of movement of the dinosaur.
- Pupils can determine the ratio of their own hip height to the length of their own feet.
- Pupils can test the relationship between the above factors and their own speed of movement across a sandy area.

**Underlying principles:**

- Trace fossils, such as footprints, can often reveal as much information about the lifestyle of an organism as the fossilised remains of the organism itself – and sometimes more.
- Empirical calculations, based on areas with unusually good preservation of fossil remains, may be used to draw numerical conclusions from less well-preserved evidence.
- Recent evidence suggests that adult *Iguanodon* walked on all four feet, but that juveniles mostly used only their hind feet.

**Thinking skill development:**

- The relationship between the foot length and the hip height; also between hip height and speed of movement establishes a pattern.
- Reasoning out why this relationship applies is metacognition
- Applying this to the dinosaur trackway is a bridging activity.

**Resource list:**

- one or more cardboard or plywood 'footprints', scaled up from the diagram above
- a tape measure
- access to a grassy area or a stretch of loose sand, such as a long jump pit
- paper; pencils; clipboards for pupils use

**Useful links:** Try the Earthlearningidea activities, 'The meeting of the dinosaurs – 100 million years ago', published 3rd March 2008 and 'How to weigh a dinosaur', published 24th March 2008. Also:
http://www.sorbygeology.group.shef.ac.uk/dino.html
http://palaeo.gly.bris.ac.uk/Palaeofiles/Tracks/default.html

**Source:** This activity was devised by Peter Loader and published by him in *Teaching Earth Sciences*, 31.2, 2006.Thanks to Peter Loader for his assistance in preparing this version of his work and for allowing the use of graphical material.