



Teacher's Activity Kit

"Tracking the Dinosaurs"

A 60 minute lesson in life history
Grades 9-12

DESCRIPTION

Students will analyze a series of dinosaur footprints and attempt to calculate the dinosaurs speed.

OBJECTIVES

Students Will:

- Define: fossil, trace fossil, comparative anatomy, footprint, trackway, fore limb, hind limb, digits, manus, pes, stride length, pace, plantigrade, and digitgrade, and Alexander's equation.
- Describe some of the environments where fossil footprints can form
- Calculate the speed of a dinosaur based on a hypothetical trackway

MATERIALS LIST

Some examples of cast or original trackway material (optional- If not available; you may use photographs taken from books, or visit the RMDRC to view their trackway exhibits); Optional experiment: 20-50 meters of plastic sheeting, waterproof paint or ink, tape measure, stopwatch, pen and paper

PART ONE

GOAL: Identifying Trackways and Trace Fossils:

ACTIVITY: Define the words: fossil, trace fossil, comparative anatomy, footprint, trackway, fore-limb, hind-limb, digits, manus, pes, stride length, pace, plantigrade, and digitgrade etc . Divide the class into several small groups. On each table, place several examples of trace fossils, or casts of fossil footprints (If not available; you may use photographs taken from books, or visit the RMDRC to view trackway exhibits). Analyze each specimen; take measurements, identify number of digits, shape, texture, etc. Have each student write a report describing the specimen and include a section on the suspected animal that made the track. Also include an estimate of the environment where the trackway formed. Discuss the results with your class.

PART TWO

GOAL: Calculate Animal Speed from Dinosaur Trackways

ACTIVITY: Using one of the theropod (three-toed, meat-eating dinosaur) trackways at the RMDRC, measure the length and breadth of one of the trackway's footprints. Based upon the length and breadth of the footprint hypothesize as to the genus of dinosaur, discuss, and estimate its hip height. Next, measure three separate stride lengths in-between footprints. Take the average of the three stride lengths. Now, plug the numbers into the following equation, (also known as *Alexander's Equation*):

$$\text{Speed (m/sec)} = 0.25 * (\text{avg. stride length})^{1.67} * (\text{hip height})^{-1.17} * (\text{gravitational constant})^{0.5}$$

The gravitational constant is the acceleration due to gravity, which works out to 9.8 meters/second². Discuss the calculated speed with your students. For additional credit, have your students write a report detailing dinosaur trackway research, and estimated speeds of various dinosaurs.

Using Alexander's equations, the follow speeds were calculated by R. A. Thulborn (1982, University of Queensland, Australia):

- Sauropodomorphs to 5 km/h (about the walking speed of people)
- Stegosaur and ankylosaur to 6-8 km/h
- Most sauropods walked about 12-17 km/h, with maximum of 20-30 km/h
- Large theropods (like T. rex) and ornithomimids to 20 km/h
- Ceratopsians to 25 km/h
- Small theropods, ornithomimids to 40 km/h
- Ornithomimids to 60 km/h
- People are estimated to run up to 23 km/h (fast sprinting speed)

PART THREE

GOAL: Calculate Animal Speed from Dinosaur Trackways

ACTIVITY: (Optional Experiment) Now, try it yourself. Take the class outdoors and try to make your own trackway. You could wait for a wet day making footprints in soft earth, or you could have someone walk over a long sheet of plastic. Improvise. Record the time it takes for a person to walk (then run), a prescribed distance, and measure their hip height. Next, measure three different stride lengths from the footprints, and take the average. Plug your numbers into the above formula and compare it to the measured speed. How close were the results and why? Discuss the outcome.

Recommended Reading

1. Barrett (2001), *National Geographic Dinosaurs*. National Geographic Society
2. Lambert, Naish, and Wyse (2001), *The Dinosaur Encyclopedia*. DK Publishing
3. Lockley, M. G. (2002). *A Guide to the Fossil Footprints of the World*. University of Colorado Press.
4. Lockley, M. G. and Hunt, A. P. 1995. *Dinosaur Tracks and other Fossil Footprints of the Western United States*. Columbia University Press.
5. Stein, W. W. (2001). *So You Want To Dig Dinosaurs*. Dragon's Claw Press
6. Taylor, Paul D. (1990). *Fossils*. Eyewitness Books, Alfred A Knopf Publishers.

At the Rocky Mountain Dinosaur Resource Center

The RMDRC is dedicated to bringing teachers and students some of the most exciting prehistoric specimens of North America. Many of our exhibits will aid teachers in their preparation for the "Tracking the Dinosaurs". Our gift shop, Prehistoric Paradise www.prehistoricparadise.com, has books, videos, specimens, posters, and replica casts for sale that would assist in classroom education. Please visit our website at www.RMDRC.com for more information.