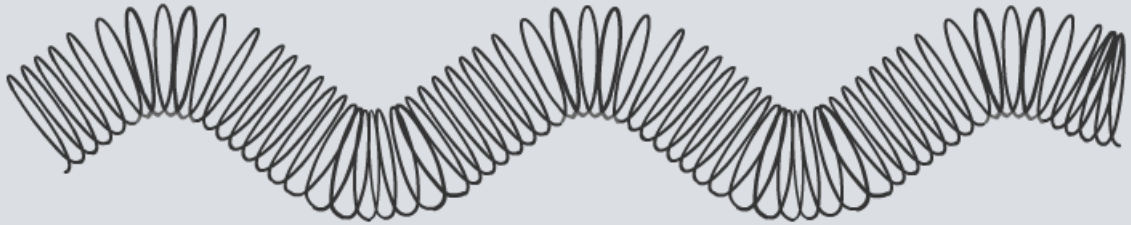
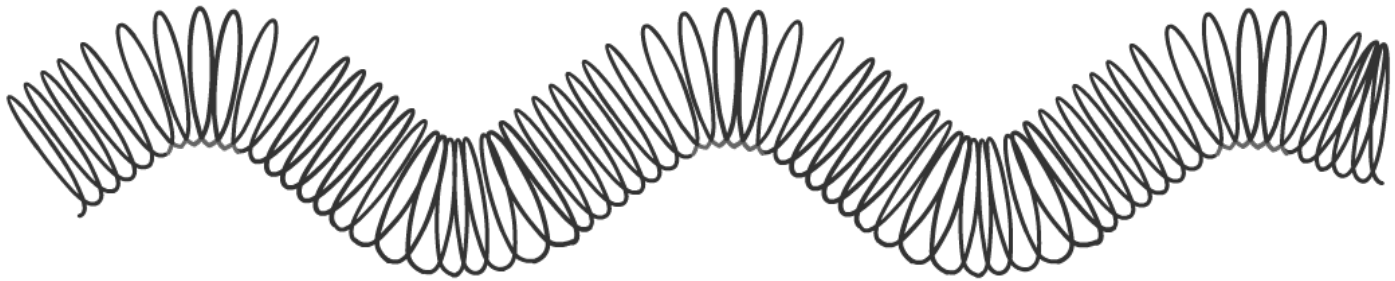
Waves



What are waves?

A **wave** is a periodic disturbance in a material (medium) or space.



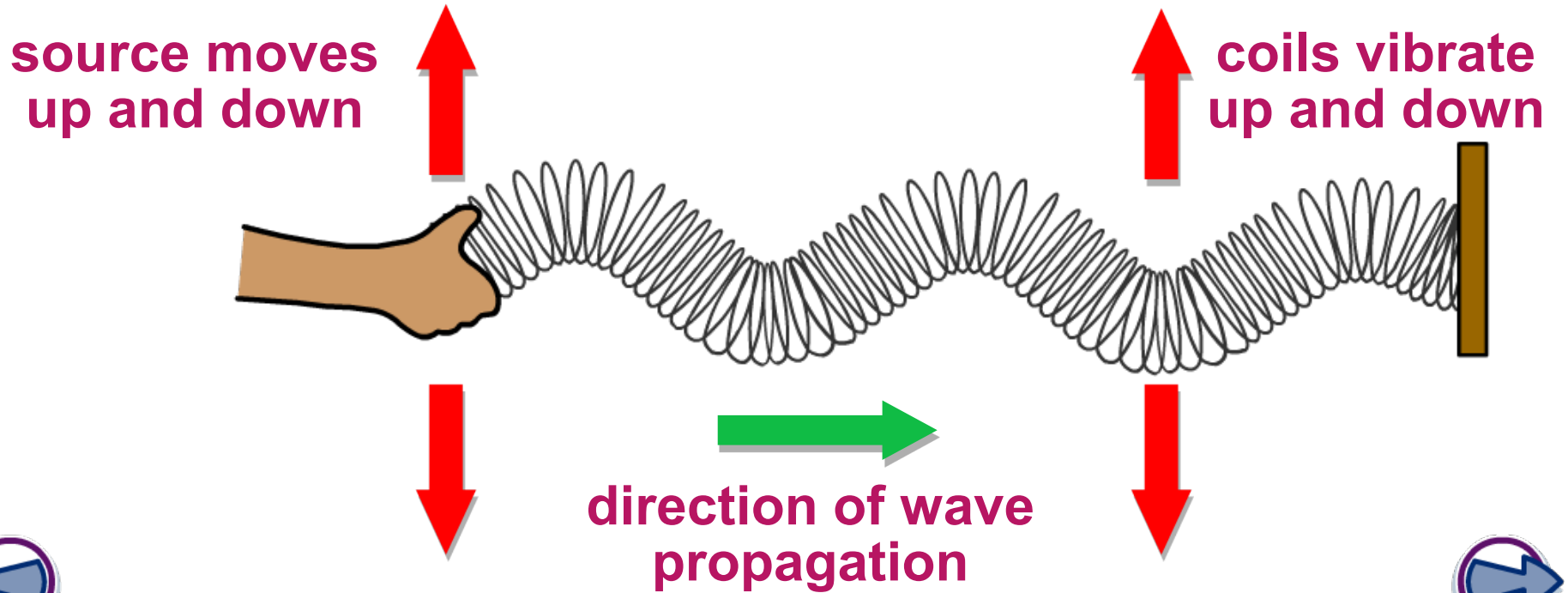
Each particle of the medium vibrates, or oscillates, around a fixed position. Energy is transferred outwards from the source of the wave.

Waves that move outwards from their source are called **progressive (traveling) waves**. The two types of progressive wave are **transverse** and **longitudinal**.

Transverse waves

In transverse waves, each particle oscillates perpendicular to the direction of propagation of the wave. There is no horizontal movement.

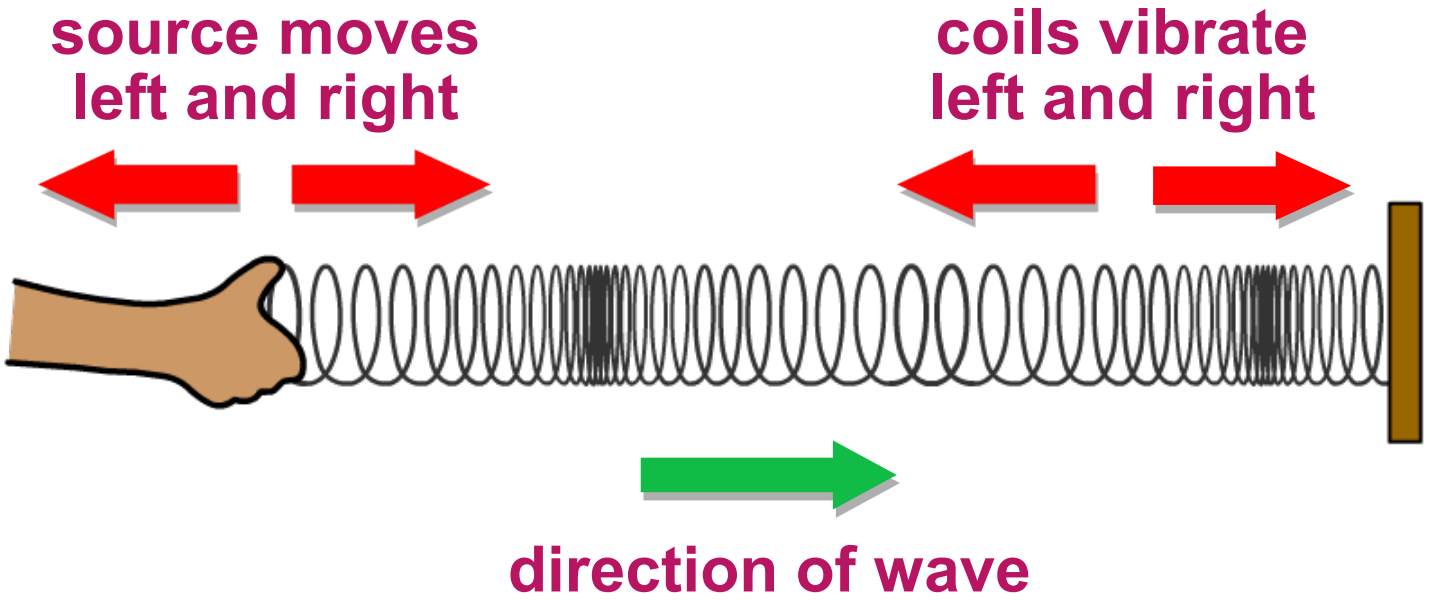
Transverse waves can be modeled by moving one end of a Slinky up and down. Each coil represents a particle.



Longitudinal waves

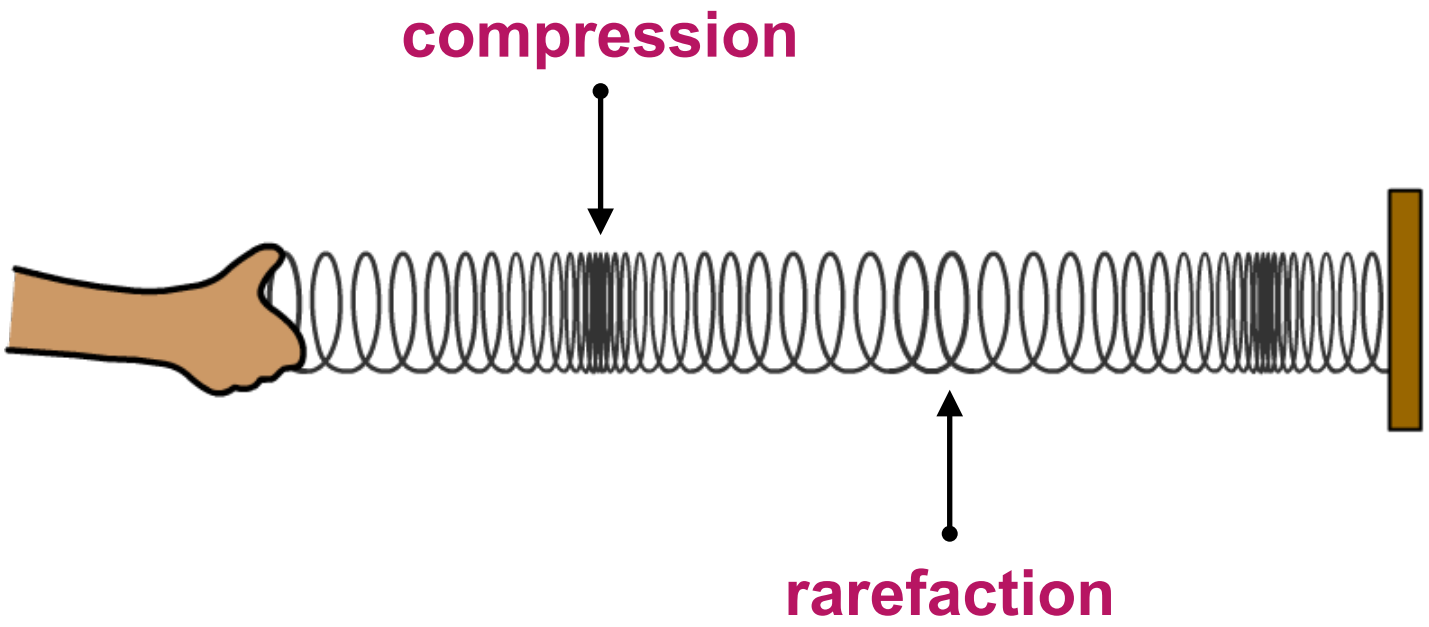
In longitudinal waves, each particle oscillates parallel to the direction of propagation of the wave. There is no vertical movement.

Longitudinal waves can be modeled by moving one end of a Slinky back and forth. Each coil represents a particle.



Sections of longitudinal waves

Within longitudinal waves, regions in which the particles are relatively close together are called **compressions**, and regions where they are relatively far apart are called **rarefactions**.



Transverse and longitudinal waves

Mechanical vs. EM waves

Mechanical waves are the oscillation of particles in a physical medium. They cannot transmit energy in a vacuum. They can be either transverse or longitudinal.

Examples include sound waves, earthquake P and S waves and water waves.

Electromagnetic (EM) waves are produced by the acceleration of charged particles, and, unlike mechanical waves, can transmit energy through a vacuum. They are always transverse waves.

Examples include microwaves, X-rays and visible light.

Examples of waves